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PALEONTOLOGY.—*Early Tertiary species of gastropods from the Isthmus of Tehuantepec.*[1] JULIA GARDNER, U. S. Geological Survey and EDGAR BOWLES, Johns Hopkins University.

Among some collections made in Mexico a number of years ago, was a small gastropod assemblage of four species, all of them unfamiliar. They had nothing in common with any known East Coast or Gulf fauna and were put aside in the hope that at some future time check material might come to light. A few months ago, in a random survey of the Federal collections, Mr. F. E. Turner of the University of California came upon them and commented on their extraordinary resemblance to middle Eocene (Domengine) species from the Simi Valley in southern California. A closer comparison further revealed the faunal similarity which is the more significant because the species are not generalized but are apparently specialized and short ranging types. Although certain elements in the Domengine fauna are present in the Umpqua formation of Oregon, there is no former record of the extension of the Domengine sea south of California. So close, however, is the resemblance between the Chiapas faunule and that from the Simi Valley, distant more than 1700 miles in an air line, that a common shore line may be reasonably postulated.

The Chiapas locality is about 12 miles east-north-east of Sayula and less than 10 miles behind the mountain front which faces the Atlantic Ocean. There is no evidence in the present material that the Atlantic had broken through, but the inter-oceanic barrier must have been extremely narrow.

The sketch map (Fig. 1) indicates the outcrop from which the collection was made.

[1] Published by permission of the Director, U. S. Geological Survey. Received March 5, 1934.

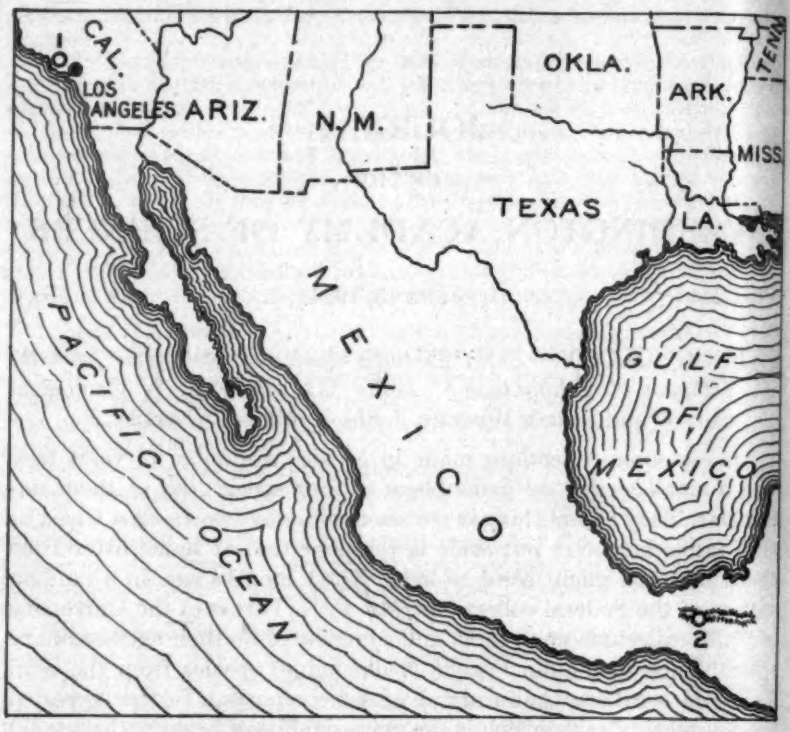


Fig. 1.—Locality 1—Simi Valley, California; 2—12 miles east-north-east Sayula, Chiapas, Mexico.

AMPULLINAE

Cernina Gray

1840. Gray, J. E. Syn. Cont. Brit. Mus., 42: 147.

Type: *Natica fluctuata* G. B. Sowerby (Recent in the south Pacific).

The type of *Cernina* is a large, not very heavy, inflated shell with a depressed spire and with a widely expanded and obliquely produced aperture. The inner margin of the aperture is broadly constricted at the base of the body. The parietal callous is very heavy but thins gradually and is spread over the body wall with no sharply defined limit excepting at the extreme anterior portion where it merges into the sharp, narrowly reverted, anterior margin of the aperture. The genotype is the only living representative of a family which was widespread during the first half of the Tertiary, both in

the Tethyan sea and in the cooler waters. Stewart[2] in his discussion of the Ampullinae recognized the need of a new group name to include "*Natica*" *hannibali* Dickerson: "*Globularia hannabali* Dickerson might be cited as an Eocene *Cernina* but it has a much heavier callous extending over the parietal region with a distinct boundary. I think it will prove to represent a separate group of *Globularia*, not directly related to *Cernina*, the latter having probably developed from Globularia in the Miocene or later." The importance of the group is increased by the recognition of an allied member many hundred miles to the south of the form described by Dickerson.

EOCERNINA Gardner and Bowles, new section

Type: *Natica hannabali* Dickerson. Middle Eocene (Umpqua formation) of Oregon.

Shell heavy; obliquely ovate. Spire depressed. Nucleus not preserved but certainly small and paucispiral. Post nuclear whorls increasing very rapidly in diameter. Aperture pyriform, expanded and obliquely produced anteriorly, the line of division between the outer lip and the parietal callous indicated by a shallow groove. Parietal callous heavy with a sharply defined outer limit, almost or entirely sealing the umbilicus and merging into the slightly reverted anterior margin of the aperture. Sculpture restricted to incrementals with occasional resting stages.

The section is founded upon the type species from the Umpqua formation of Oregon and its variants in the Domengine formation of southern California and a new species from the Isthmus of Tehuantepec.

Ampullina sphaerica Deshayes from the upper Eocene of the Paris Basin shares with the American forms the depressed spire, heavy shell, and parietal callous.

Cernina (Eocernina) **chiapasensis** Gardner and Bowles, n. sp.

Fig. 2, 3.

Shell subglobose, smoothly inflated; spire depressed. Nuclear whorls not preserved but doubtless small in size and few in number. Post-nuclear whorls 4 to 5, increasing rapidly in diameter; body whorl largely enveloping the earlier volutions, inflated, obtusely shouldered. Sculpture consisting only of fine incremental lines, most evident on the body whorl. Sutures regular, clearly defined, and deeply impressed. Aperture wide and flaring, anteriorly produced. Parietal callous heavy. Umbilicus almost or entirely covered by the encroaching callous.

Dimensions: Height, 36 millimeters; greatest diameter, 38 ± millimeters (aperture of specimen incomplete).

Holotype: U. S. National Museum No. 373046.

Paratype: U. S. National Museum No. 373047.

Type locality: U. S. Geol. Survey Sta. No. 13230, about 12 miles east-north-east of Sayula, Chiapas, Mexico. Eocene.

The closest analogue of this species is *Ampullina hannibali* Dickerson[3] from

[2] STEWART, R. B. Acad. Nat. Sci. Philadelphia, Proc. 78: 331. 1926.

[3] DICKERSON, R. E. California Acad. Sci. Proc., ser. 4, 1: no. 4, p. 119. *pl. 12, figs. 5a, 5b.* 1914. (as *Natica hannibali*).

the middle Eocene (Umpqua formation) of Oregon, and the variants in the Domingine of the Simi Valley, California. The West Coast species differs from *A. chiapasensis*, however, in its less inflated and more obliquely shouldered body whorl; its higher spire; its more flaring aperture; and the heavier callous which completely seals the umbilicus. The apparent perforation in the umbilicus of the holotype is, however, increased by the broken margin of the callous.

Cerina chiapasensis is represented by the holotype and a smaller paratype, measuring 28 millimeters in height and 26.5 millimeters in maximum diameter.

AMAURELLINA "Bayle" Fischer 1885

1885. Fischer, Paul, Manuel de Conchyliologie. 8: 766. 1885.

Type by monotypy: *Ampullaria spirata* Lamarck. Eocene of the Paris Basin.

Amaurellina malinchae Gardner and Bowles, n. sp.
Fig. 5.

Shell of medium size. Spire more than one-third as high as the entire shell; scalariform. Nuclear whorls not well preserved or clearly differentiated from the conch. Post-nuclear whorls probably 5 in number, regularly increasing in size, those of the spire rudely trapezoidal in outline. Body whorl angular posteriorly, elongated and tapering anteriorly. Shoulders sharply carinate, sloping inward from the pinched and elevated keel to the distinct but not conspicuous sutures; space between the suture and the keel irregularly threaded with about 8 spiral lirae overridden by fine, crowded incremental laminae. Aperture crushed in the type but apparently long and narrow, anteriorly produced. Parietal callous heavy, almost—and possibly in a perfect specimen, entirely—sealing the umbilicus, merging into the margin of the outer lip.

Dimensions: Height, 39 millimeters; greatest diameter, 24 millimeters.

Holotype: U. S. National Museum No. 373050.

Type locality: U. S. Geol. Survey Sta. No. 13230, about 12 miles east-north-east of Sayula, Chiapas, Mexico. Eocene.

Amaurellina moragai Stewart[4] from the Tejon of California is more inflated and more ovate in form, and the whorls are less sharply angulated. *Amaurellina moragai lajollaensis* Stewart,[5] from the Domengine horizon is less inflated than the Tejon form, but the whorls are not so sharply keeled as in *A. malinchae*. *Amaurellina malinchae* is known only from the holotype.

Amaurellina cortezi Gardner and Bowles, n. sp.
Figs. 7, 9.

Shell heavy, squat-ovate; spire moderately high for the group, obtusely scalariform. Whorls about 6 in number, regularly increasing in size, obtusely shouldered. Sutures distinct, impressed. Shell smooth excepting for an in-

[4] STEWART, R. B. Op. cit. 334. *pl. 18, fig. 3.*
[5] STEWART, R. B. Op. cit. 335. *pl. 28, fig. 2.*

cremental sculpture which is unusually strong, sharp, and regular. Aperture semilunate; outer lip entire. Inner wall covered by a heavy callous completely sealing the umbilical opening.

Dimensions: Height, 32.5 millimeters; greatest diameter, 27.0 millimeters.

Holotype: U. S. National Museum No. 373048.

Paratypes: U. S. National Museum No. 373049.

Type locality: U. S. Geol. Survey Sta. No. 13230, about 12 miles east-north-east of Sayula, Chiapas, Mexico. Eocene.

There are 18 paratypes of this species in the Chiapas collection. Many of these are broken or poorly preserved and the largest is 46 millimeters high. *Amaurellina clarki* Stewart,[6] so abundant in the Domengine of the Simi Valley, differs from *A. cortezi* in the relatively higher and more turrited spire, the less inflated and more produced body whorl and the less expanded aperture.

VOLUTIDAE

Volutocristata Gardner and Bowles, n. gen.

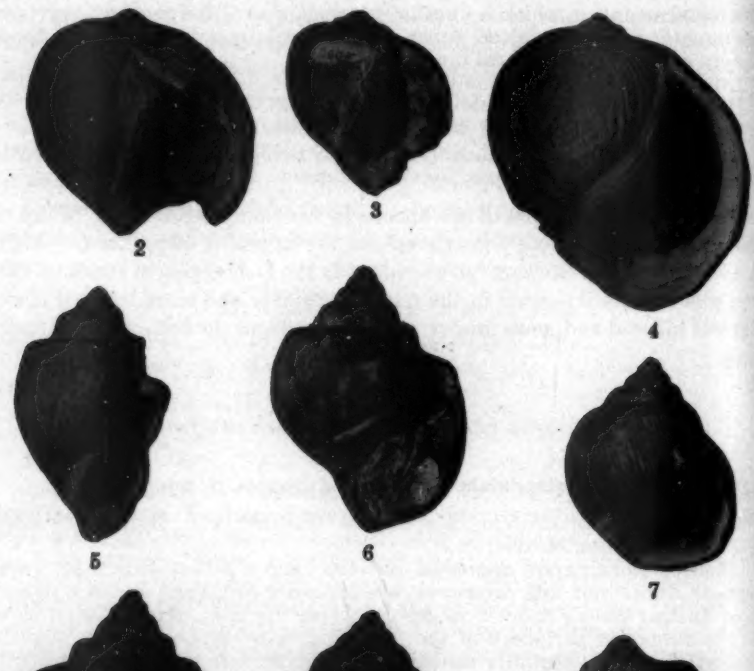
Genotype: *Volutocristata chiapasensis* Gardner and Bowles. Middle Eocene of Chiapas, Mexico.

Shell coniform; spire depressed but the apex a rather prominent boss; nuclear whorls not well preserved, but certainly small and few in number; post nuclear whorls about 5 in the genotype, the later whorls wound close to the tubercled periphery of the preceding volution; body conic, slightly concave laterally; abruptly shouldered; apical surface ornately sculptured; early whorls with 11 to 13 prominent axial ribs which on the later whorls are reduced to erect peripheral tubercles evanescing on the body within the posterior third; incremental striae crowded and rather sharp; axial sculpture overridden by fine, crowded, somewhat irregular lirae; base of body obliquely sulcate, the grooves more closely spaced anteriorly; sutures distinct, undulated by the peripheral nodes of the preceding volution; aperture narrow, elongate with subparallel margins; outer lip entire with a simple, bevelled edge; columellar wall plicate, the anterior fold the strongest and the most oblique, the 4 or 5 behind it less sharply defined and irregular in size and spacing and almost at right angles to the axis of the shell; all of the folds deep-seated and visible only in the broken shell or in moulds; parietal callous heavy, washed backward over the preceding volution in the adult whorls; anterior fasciole narrow, the terminal notch shallow.

This genus has been erected to accommodate two similar and remarkable volutes, *Plejona lajollaensis* Hanna[7] from the Domengine (middle Eocene) of California and *Volutocristata chiapasensis*, the genotype, from the Isthmus of Tehuantepec. They are characterized by the conspicuously coniform outline, depressed spire, crested periphery and the very narrow aperture with sub-parallel margins.

[6] STEWART, R. B. Op. cit. 336. *pl. 26, figs. 8, 9.*

[7] HANNA, M. A. Univ. California Dept. Geology, Bull. 16: no. 8, p. 320. *pl. 52, figs. 1, 2.* 1927. "*Pejona*" by typographical error.



Figs. 2–13.—For explanation see opposite page.

The genus *Volutoconus* of Crosse[8] though suggesting a coniform shell includes species with a more typically volutoid aperture, rounded shoulders and an oliviform rather than coniform outline.

The form most closely resembling *Volutocristata* pictorially is *Diploconus crassus* Douvillé[9] from the *Cardita beaumonti* beds of northern India.

The genus *Diploconus* was erected by Douvillé[10] to cover two species, the genotype *D. elegans*, a relatively high-spired form, and *D. crassus*. *Diploconus* was referred to the Fusidae in which Douvillé included *Turbinella*, but in his discussion, he emphasized the characters common to the Strombidae and recognized in *Diploconus* an indicator of a common ancestry for the fusids and strombs. Douvillé's figures suggest that the outer lip in adult *Diploconus* is pulled slightly backward over the preceding whorl as it is in the strombs, but this is not true of the American forms and may not be true of the Indian, for the material figured by Douvillé is mostly in the form of incomplete moulds. The columellar folds of the Indian species seem stronger and more oblique but this difference is probably more apparent than real for the folds of the American species are deep seated and can be adequately observed only in the broken shell. No genetic relationship between the Indian and American faunas can be surely established on the material available, but such a relationship is a possibility of unusual interest as it involves the early migration routes of the Tethyan faunas. The Tethyan, the ancestral Mediterranean, sea was presumably closed on the west by the "Cathaysia" of Grabau, and was thus isolated from the equatorial Pacific, though it may have been open to the Atlantic by way of northern Africa. Forms similar to *Diploconus* are unknown in either the fossil or the Recent Japanese faunas.

Among the American volutes, the closest relationship may perhaps be found with *Volutocorbis* Dall, a group remarkably prolific in the American Eocene. Variants of the genotype, *Volutilithes limopsis* Conrad from the

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Fig. 2–3. *Cernina* (*Eocernina*) *chiapasensis* Gardner and Bowles. 2. Apertural view of holotype, ×1. 3. Apertural view of paratype, ×1. Fig. 4. *C.* (*Eocernina*) species cf. *C. hannabali* (Dickerson) from the Simi Valley,[11] California. Apertural view, ×1. Fig. 5. *Amaurellina malinchae* Gardner and Bowles. Apertural view of holotype, ×1. Fig. 6. *A. clarki* Stewart from the Simi Valley, California. Apertural view, ×1. Fig. 7. *A. cortezi* Gardner and Bowles. Apertural view of holotype, ×1. Fig. 8. *A. clarki* Stewart from the Simi Valley, California. Rear view of individual shown in Figure 5, ×1. Fig. 9. *A. cortezi* Gardner and Bowles. Rear view of individual shown in Figure 6, ×1. Fig. 10–12. *Volutocristata chiapasensis* Gardner and Bowles. 10. Apical view of paratype, ×1. 11. Apertural view of holotype, ×1. 12. Apertural view of holotype broken to expose columellar plications, ×1. Fig. 13. *V. lajollaensis* (Hanna) from the Simi Valley, California. Apertural view, ×1.

[8] CROSSE, H. JOUR. DE CONCHYL., ser. 3, 19: 306. 1871.

[9] DOUVILLÉ, HENRI. *Les Couches a* Cardita Beaumonti. Geol. Survey of India, Mem., Paleontologia Indica, new ser., 10: 38, *pl. 7, figs. 8, 9.* 1929.

[10] Idem., p. 136.

[11] All of the specimens from the Simi Valley are from U. S. Geol. Survey Sta. No. 12632, collected by W. P. Woodring on the north side of the Simi Valley, on the east side of Las Llajas Canyon, 6850 feet South 17½° East from Bench Mark 2165, Ventura County, California.

Gulf Eocene, are widespread in the lower Claiborne of Texas and northern Mexico. There are numerous obvious differences between the genera, the most significant, perhaps, being the more regular and stronger plications upon the pillar of *Volutocorbis*, which unlike those of *Volutocristata*, emerge at the aperture. In *Volutocorbis*, however, as in *Volutocristata*, the parietal wash is extended backward upon the preceding whorl in adult individuals, and the two groups are similar in the direction of the growth lines, the grooving upon the base of the body, the characters of the anterior fasciole, and the general sculpture pattern.

Volutocristata chiapasensis Gardner and Bowles, n. sp.

Figs. 10–12

Shell of moderate dimensions and rather heavy, coniform. Spire depressed but the apex a prominent boss. Body elongate-conic, gently tapering and slightly concave, laterally. Nuclear whorls imperfectly preserved and differentiated but certainly small and few in number. Post-nuclear whorls about 5, rapidly increasing in size, conspicuously shouldered. Post-nuclear axial sculpture gradually changing from narrow ribs continuous from suture to suture on the early whorls to prominent peripheral nodes on the later, the number running from 11 to 13 to the whorl; fine spiral striae superposed upon the axials, strongest relatively and most regular upon the early volutions; base of body obliquely sulcate, the grooves more closely spaced anteriorly; sutures incised, undulated by the axials of the preceding whorl. Aperture narrow, the margins sub-parallel. Outer lip simple, the edge bevelled. Pillar wall plicate, the folds deep seated and not emergent at the aperture; anterior fold the strongest and the most oblique; the 4 or 5 folds behind it irregular and approximately at right angles to the axis of the shell. Parietal wash moderately heavy, transgressing the shoulder on the last two volutions and partially overriding the peripheral nodes. Anterior fasciole narrow and inconspicuous; the terminal notch very shallow.

Dimensions: Height, 39.5 millimeters; greatest diameter, 23.5 millimeters.

Holotype: U. S. National Museum No. 373044.

Paratype: U. S. National Museum No. 373045.

Type locality: U. S. Geol Survey Sta. No. 13230.

Volutocristata chiapasensis is represented by the holotype and a broken paratype consisting of the apical portion only. The maximum diameter of the paratype is 34 millimeters and the axial nodes total 55 or 56. *Volutocristata lajollaensis* (Hanna) from the Domengine of southern California is the only known American species remotely resembling specifically our Mexican form. It differs in the relatively broader body whorl; the less sharply angulated keel; the less prominently elevated but more acute peripheral nodes; the more posterior suture which follows closely the periphery of the later whorls rather than falling a little in front of the periphery as it does in *V. chiapasensis;* and the sharper, more uniform and more regularly spaced columellar plications.

PALEONTOLOGY.—*New Carboniferous invertebrates*—IV.[1] GEORGE H. GIRTY, U. S. Geological Survey.

This paper contains descriptions of one brachiopod from western Texas, five gastropods from Colorado, and three gastropods from Arkansas.

Cryptacanthia? robusta n. sp.
Figs. 1–7.

Shell rather large for the genus, subpentagonal in outline, highly inequivalve with reversed curvature, the pedicle valve having a pronounced fold and the brachial valve a pronounced sinus.

The pedicle valve is widest at the mid-length or just above and somewhat emarginate in front with an outline more or less conspicuously pentagonal. Longitudinally, this valve is gently arched toward the anterior end, but shows a rapidly increasing curvature toward the beak which rather strikingly overhangs the brachial valve. Transversely, the median part is more or less planate at the anterior end, the flattened zone contracting posteriorly to form a narrowly rounded ridge which terminates in the small incurved beak. From this flattened median part the lateral slopes descend steeply and to an uncommon length, causing the valve to be correspondingly convex. The lateral slopes are flattened or even somewhat concave and they seem to flare slightly in the region of the cardinal angles. On some specimens the descent from the fold is so abrupt close to the anterior margin as to produce two short but pronounced grooves and to give that structure, which would otherwise be undefined, distinct boundaries and a quadrate shape. The beak in my specimens is imperfect but it appears to have been truncated by a round foramen without any collar formed by the introverted shell margin adjacent.

The brachial valve is subquadrate in outline and moderately convex. It is strongly and more or less abruptly deflected at the sides and across the front, leaving a median area (for half or two-thirds of the length) which is but slightly arched. The sinus, which makes its appearance back of the middle of the valve, is in the beginning a narrow groove, but it widens rapidly and somewhat abruptly, the bottom, at the same time, becoming more rounded and at the anterior margin almost planate. There, the part included in the sinus projects as a linguiform extension which is folded downward at a strong angle, one, however, appreciably greater than 90 degrees. The parts on either side of the sinus are also deflected downward, though less strongly than the sinus itself, with an almost truncating effect. As an extreme expression this valve is planate over the posterior part and abruptly flexed along three sides, so that the planate area has a certain definition. The lateral and anterior folds in conjunction with the broad deep sinus, cause this area to terminate on either side in prominences almost like little mounds.

Of internal structures little is known except that the pedicle valve is provided with dental plates and the brachial valve with a strong median septum. The shell substance is finely punctate.

[1] For the previous paper in this series see this JOURNAL 21: 390–397. 1921. Published by permission of the Director of the U. S. Geological Survey. Received Sept. 19, 1933.

C. robusta so closely resembles *Cryptacanthia compacta* as to raise a doubt whether it is more than a very robust form of that species, yet the facts regarding both are so incompletely known and in certain respects so at variance as to suggest that they belong to distinct genera. The possibility that they belong to different genera is opposed by their close external similarity. Such a resemblance would mean little or nothing between many species but in this instance it is significant because the configuration which these two possess in common is highly exceptional and distinctive. On the other hand, the original description of *C. compacta* does not mention the dental plates and median septum which are shown by the present species, and it does give the character of the brachidium whose characters in the present species have not been determined.

C. compacta is one of the rarest of Carboniferous brachiopods and no first hand description of it has been published since 1868 until very recently. Dunbar and Condra, however, redescribe the genus with some additional characters among which, significant in the present connection, are the presence of dental lamellae in the pedicle valve (a character which could be predicated with reasonable assurance as it is found in all or nearly all Carboniferous Terebratuloids) and the absence of a median septum in the brachial valve. I hesitate to challenge the character last mentioned and at the same time cannot accept it unconditionally for the following reasons. I have examined specimens of *C. compacta*, especially one from the Murphysboro quadrangle (station 6129) in which a median septum certainly appears to be present, though it may not have the form of a thin high plate. Furthermore, the specimen which supplied the structural characters described by Dunbar and Condra and which in their sections seem to afford conclusive evidence that a septum was absent, came from New Mexico and is strikingly unlike the authentic specimen shown by the original publication. Their figures (p. 309) represent a shell that is much more elongate, that is ovate in outline instead of pentagonal, and that has a moderately convex instead of a nearly flat brachial valve. On these grounds one might infer that their specimen did not belong to *C. compacta* and might not belong to *Cryptacanthia* at all. These differences are less marked, however, if the figures on p. 309 are compared with figures on plate 37 representing specimens from Kansas and Illinois. The fact that a median septum was not mentioned in the original description cannot be taken as corroborating the observations of Dunbar and Condra for the original description also failed to mention the much more obvious dental lamellae.

If *Cryptacanthia* did indeed lack a median septum in the brachial valve, the present species can hardly remain in the same genus as *C. compacta*. In the presence of this septum it suggests the genus *Heterelasma*, not to mention *Girtyella* and others, but in configuration it is the reverse of *Heterelasma* whose characters in this category are singularly misrepresented in the American Zittel. In that usually accurate work the genus is summarized as

comprising "smooth Dielasmids with a ventral fold and a dorsal sinus." In point of fact, the transverse curvature of the ventral valve in *Heterelasma* is concave, in other words, it has a sinus not a fold, and that of the brachial valve is convex, but the convex curvature is reversed in the anterior part which is indented by a more or less conspicuous sinus. The present species which really has a fold in the ventral valve and a sinus in the dorsal valve might well belong in *Heterelasma* as the genus is represented in Zittel, but not as it is in fact. If it does not belong in *Heterelasma* by reason of the reversed curvature of the valves, or in *Cryptacanthia* by reason of the median septum in the brachial valve, its generic affinities are hard to discover. In configuration it recalls the Jurassic genus *Glossothyris* and in default of a suitable generic locus the term *Glossothyropsis* might be used for it.

In its specific relations as already pointed out *C. robusta* greatly resembles *Cryptacanthia compacta* and when the doubtful points are cleared up, it may belong in the same genus. As a summary of the differences at present known, aside from those of generic significance, *C. robusta* is much larger; the lateral outlines appear to contract more gradually forward so that the anterior outline is broader than it is in *C. compacta;* the two valves appear to be much less unequal in convexity, the pedicle valve being somewhat lower and not so angular along the median line, and the brachial valve not quite so planate; and the fold and sinus are higher and conspicuously quadrate in outline. These differences can not be wholly vouched for, as the original description and figures of *C. compacta* are inadequate in several respects, and as specimens are rare. I have been able to examine only 10 or 12 specimens, all of them small and more or less broken. Their imperfections tend to vitiate the identification, but it is probable that they belong to *C. compacta.* The fact that *C. robusta* occurs in a widely unlike fauna of much later geologic age adds significance to the differences already known and gives promise of others when our knowledge is more complete.

C. robusta occurs associated with *Pugnax bisulcata,* which it resembles so closely in configuration that on a hasty examination the two species might readily be confused; the resemblance, of course, is only superficial and scarcely that, inasmuch as it exists only through a reversal of the valves, the pedicle in this species resembling the brachial valve in that and vice versa.

Delaware Mountain formation (Permian); True Canyon, 7 miles northwest of 7-Heart Gap, Culberson County, Texas (station 6452).

Pleurotomaria worthenioides n. sp.

Figs. 8, 9.

Shell small, conical, turreted, consisting of 5 or 6 volutions. Apical angle less than a right angle but varying with different specimens. Aperture rhombic. In the final volution the peripheral region is occupied by two large rounded carinae which inclose between them a flattened and much depressed

zone containing the slitband. The lower of the two carinae is almost basal and is slightly smaller and less prominent than the upper. The surface between the suture and the upper carina is broad, strongly oblique, and nearly flat though it is slightly tumid near the suture and more or less spreading as it joins the carina. The lower surface is gently convex and nearly horizontal except that near the axis it bends strongly upwards. The whorls embrace up to the lower carina which is concealed in some specimens and partly exposed in others. The upper carina on the other hand forms a conspicuous projection and lends the shell its turreted appearance. The axis seems to be imperforate.

The lateral surface is marked by 6 or 7 fine, sharp, revolving lirae which diminish in size from above downwards and are separated by interspaces wider than the lirae themselves. About 4 similar lirae, but finer and more crowded, occur on the upper carina and two or three others like them on the lower carina. The lower surface is marked by about 10 revolving lirae which are coarser and stronger than those of the lateral surface, and stand rather more than their own diameter apart. The interspaces gradually diminish toward the axis and the lirae decrease in size and strength in the same direction. The sculpture also comprises fine, regular lamellose transverse lirae. On the lateral surface they decrease in size individually from above downward and are perhaps a little more delicate than the revolving lirae and possibly a little more closely arranged. They form with the revolving lirae a regular cancellated sculpture marked at the intersections by minute but conspicuous nodes. The transverse lirae are well developed upon the upper carina, cancellating the revolving lirae that occur there, and they reappear on the lower carina. Over the basal surface they are a minor feature. If well developed or well preserved they are sharp and clear, but much more delicate and much more closely arranged than the revolving lirae which they cross as crenulations rather than as nodes. The slitband occupies nearly the whole of the depression between the two carinae and is defined by lamellose lines partway up its sides. The slitband is divided longitudinally by a slender revolving lira set with minute, closely arranged, uniform nodes, whereas each of the divisions is subdivided by a lira more or less inferior in size. In the slitband the transverse lirae appear as delicate close-set lunettes which on many specimens are somewhat difficult to make out and are chiefly apparent by reason of the nodes that they produce in crossing the median lira.

On the lateral surface the growth lines have a strong backward trend from the suture and a slight convexity toward the aperture. In crossing the slitband of course they are conspicuously arched with the convex side facing backward. On the lower surface their general direction is about transverse but they retreat into a broad shallow concave arc just below the lower carina and make a short shallow convex arc in the axial region.

This species is not exactly rare; about 25 specimens, large and small, have been examined, but only a few of the large ones are well preserved, whereas the small ones are identified with less accuracy. Some of the variation observed is probably due to imperfect preservation. That the revolving lirae vary somewhat in number and arrangement scarcely need be specified. In some specimens revolving lirae seem to be obsolete on the carinae, the transverse lirae alone being distinguishable. The carinae then appear flat on top instead of rounded. The delicate though sharp lunettes in the slitband are

more often invisible than seen, and the transverse lines of the lower surface may be sought for in vain. Probably they are fully developed, but are subdued to the strength of growth lines, or obscured by abrasion. On a few small specimens from Woolsey, Ark. (station 2849) the upper carina is uncommonly thin and prominent.

Brentwood limestone member of the Bloyd shale (early Pennsylvanian); SW¼ sec. 27, T13N, R32W, Winslow quadrangle, Arkansas (station 3733).

Euconospira hermosana n. sp.
Figs. 10–12.

Shell small, conical, composed of about seven gradually enlarging volutions. The spire comprises half, or a little more than half, of the entire height, and the height is slightly greater than the width of the last volution.

Final volution somewhat rhombic in section and strongly carinated around the periphery which is at the mid height or somewhat below. The lateral surface, which is slightly concave, descends steeply from the suture. The lower surface, which is gently convex, descends from the periphery inward, but in the axial region it rather sharply assumes an upward direction. The peripheral zone is occupied and truncated by the slitband, which is rather narrow and depressed between two thin strongly projecting lamellae. Below the carina, that is, on the lower surface but in the peripheral part, there is a narrow groove which in width is about equal to the slitband, and which is separated from the slitband by the lower of the two bounding lamellae; below this again and of about the same width there is a narrow, rounded ridge. The volutions embrace to this spiral ridge, so that the carina forms a somewhat conspicuous projection winding around the shell, but losing its elevation as it approaches the apex.

The surface is crossed by numerous slender, sharply elevated transverse lirae distinctly narrower than the striae between them, little difference in sculpture being observable between the lateral and basal parts. On the upper surface these lines are at the same time convex (toward the aperture) and oblique, with a rather strong backward swing. On the lower surface they are sinuous but on the whole generally transverse in direction. Starting at the slitband they have for a short distance a forward direction but turn backward as they cross the revolving ridge on the basal surface. Thence, they make a broad shallow reentrant curve, followed by a broad shallow convex curve, the change in direction occurring about midway on the lower surface. As these lines necessarily converge toward the axis, many that begin at the carina die out or become confluent to form lirae of larger size; the others apparently become somewhat strengthened so that the peripheral half of the lower surface is more finely striated than the axial half. In the slitband the transverse lines make distinct lunettes, the markings here being similar to those elsewhere on the shell but considerably finer. Traces of extremely fine spiral lines have been observed in the slitband. They are interrupted by the lunettes or confined to the spaces between them. Some 5 or 6 of the transverse lirae of the upper surface are spanned by 1 mm., the measurement being made at right angles to their oblique direction. On the lower surface the liration is somewhat finer near the carina but it becomes as coarse if not coarser toward the axis through confluence or fasciculation of the lirae.

In typical *Euconospira* the surface is crossed by spiral as well as trans-

verse lines, producing a cancellated ornamentation. *Euconospira Hermosana* has no such spiral lines, and this fact although it is not regarded as debaring it from *Euconospira*, at once distinguishes it from a number of species there referred. Several species of *Euconospira*, it is true, have only traces of spiral lines (such as the very robust *E. taggarti*), or have spiral lines only on the under surface. *Pleurotomaria coniformis*, *P. conulus*, and *P.* (*Bembexia*) *elegantula*, which possibly should be referred under *Euconospira*, have, like the present species, only transverse lirae, but they are sharply distinguished from it in other ways.

McCoy formation of Roth (Pennsylvanian); McCoy, Colorado.

Pleurotomaria rockymontana n. sp.
Figs. 13–16.

Shell of moderate size, elongate, conical, composed of 10 or more gradually enlarging volutions. Spire about twice the height of the final volution and distinctly but not strongly turreted.

Final volution irregularly rhombic in section with the basal surface gently convex and almost horizontal, with the lateral surface strongly oblique, and with the carinated periphery sharply rounded or subtruncate. The lateral surface is slightly sinuate, somewhat protuberant in the upper part and somewhat flaring in the lower. The peripheral angle, which is rounded as just described, is the locus of 2 revolving ridges or carinae of which the higher is slightly the more prominent. Adjacent to the lower carina, but on the underside of the volution is a third ridge distinctly inferior in size and prominence. It is separated from the lower carina by a narrow groove, somewhat narrower and shallower than the groove inclosed between the two peripheral carinae.

The lateral surface of the final volution is crossed by small spiral and transverse lines which form a regular and fine cancellation marked with little nodes where the lines intersect. The spiral lines are slender and spaced at about their own width or somewhat more. They are subequal but gradually diminish in size and prominence from above downward. About 8 can be counted on one specimen; one or two more on others. The transverse lines are about the same in size and spacing as the spiral ones on some specimens but on most they are the dominant feature being conspicuously stronger and more widely spaced. They are in the upper part almost straight and almost direct but bend backward more or less strongly as they approach the upper carina so that they have, in that degree, a general backward trend.

The markings of the peripheral zone vary much in detail on different specimens, probably due to the minute character of the units and to their imperfect and unequal preservation. Where most clearly distinguishable the slitband is a narrow flat ribbon deeply depressed between the two peripheral carinae. It appears to be defined by delicate lirae on the sides of the carinae and it is marked by very fine, closely arranged lunettes. The occurrence of the lirae is such that the carinae sometimes appear to be surmounted by two revolving lirae. This is especially true of the lower carina because it is somewhat smaller and less prominent than the upper, and the lira on its inner side is more on a parity with it. In one specimen the slitband is not distinguishable as such, but instead the groove between the carinae appears to be occupied by several fine spiral lines. These features are not shown clearly or

in detail, however. The transverse lirae apparently do not pass the upper carina, which is not crenulated, and when they reappear in the slitband they are very much finer and more closely arranged. Nor have they been detected on the lower carina, but in the groove just below it the transverse lines reappear with a sharp expression and with a marked forward slant from above. Traces of fine spiral lines are also shown here by some specimens, and probably they are a constant feature. The sculpture of the basal surface from the lower carina to the axis, is not well shown. It seems to be cancellated like the lateral surface, but more finely. The revolving lirae are more slender, more closely arranged and consequently more numerous, and the transverse lines are even finer. They are greatly inferior to the transverse lines of the lateral surface so that whereas there the transverse lines are the dominant feature, the spiral lines have here the dominant part. The volutions embrace so as partly to conceal the lowest of the three revolving ridges that occupy the peripheral zone exposing, however, its crest together with the groove above it and the two peripheral carinae with their included groove. These projections break the regular slope of the spire and give the conical shell its somewhat turreted shape.

This species appears to resemble *P. adamsi* in a general way. Worthen's description, however, is not clear, in fact seems to be contradictory regarding certain details. In point of sculpture it mentions only spiral lines on the two carinae which inclose the slitband. One part, at least, of the final volution is said to be smooth, apparently the basal surface ("smooth below the spiral band"); this is not true of any part of *P. rockymontana*. *P. adamsi* also has a wider spiral angle. *P. giffordi* is on the whole somewhat more similar but it has fewer spiral lines on the lateral surface and apparently no transverse lines at all; there are other differences as well, such as showing a greater depth of shell below the slitband in the final volution and above the suture in the higher ones and lacking a third ridge below the two carinae that inclose the slitband. *P. subdecussata* and *P. rockymontana* are also comparable in a number of details, more in sculpture than in configuration, as *P. subdecussata* has a much lower spire. *P. subdecussata* resembles the present species and differs from the two previously mentioned, in having the lateral surface finely cancellated by numerous revolving and transverse lines, but like the foregoing it appears to lack the additional carina below the two on the periphery.

McCoy formation of Roth (Pennsylvanian); McCoy, Colorado (station 6714).

Orestes? reticulatus n. sp.

Figs. 17–19.

Shell rather small, subconical, composed of about seven volutions. Width and height nearly equal.

Final volution rhombic in section with the peripheral line well-nigh basal. The lateral surface juts out at the suture to form a narrow shelf-like projection which, though slightly inclined is almost horizontal. From this tablet, which it meets in a pronounced angle, the main part of the lateral surface, sloping steeply, drops down to the periphery without material interruption.

The peripheral angle, which is about 60 degrees, is somewhat truncated or sharply rounded. The lower surface is almost planate and almost horizontal. It descends appreciably from the peripheral angle and in the axial region makes a sub-angular turn, bending upward with a slight obliquity. The axis is solid and the lip slightly reflexed to form a false umbilicus. The rather broad slit band occurs just above the periphery and is sharply defined by two rather thick prominent lirae. Just below the lower of these lirae but still above the peripheral line the surface retreats into a rather narrow deep rounded groove, and this is followed by the periphery itself, consisting of a narrow rounded ridge which in width is about equal to the groove above and in prominence scarcely exceeds the guarding lirae of the slitband. Thus the peripheral region is marked by three slender ridges or carinae separated by two grooves. The lower carina is decidedly thicker than the two above that inclose the slitband, and the slitband or upper groove is much broader than the lower. The volutions embrace up to and including the lowest ridge, so that the groove above and the slitband are exposed. This gives the shell as a whole an obscurely turreted appearance. As the whorls are followed backward up the spire, they lose their angulated shape and become more regularly rounded.

The sculpture in general terms consists of a rather coarse reticulation made by sharply raised revolving lirae crossed by transverse lirae of about the same size and spacing. Small but rather conspicuous nodes emphasize the points where the lirae intersect. Reckoning the sharp edge of the shelf-like projection below the suture as a lira, from 6 to 8 revolving lirae occupy the lateral surface and an additional lira not uncommonly occurs upon the subsutural tablature. The lirae are as a rule rather regular in size and spacing, but they may vary greatly, and in both items they show a general diminution downward toward the slitband. The two slender lirae that inclose the slitband are not distinguished from the lirae above except that they are a little more prominent and are not affected by the transverse lirae. They are smooth or in places finely notched or crenulated. Two rather small spiral lines close together form the peripheral curve or carina (wherefore its rounded instead of angulated shape) and from 10 to 13 others are developed on the lower surface. This part of the shell is somewhat more finely marked than the lateral surface, the lirae being more slender and the intervals narrower, though on both surfaces the intervals are decidedly wider than the lirae. The slitband generally appears to be without spiral lines and to be marked only by the usual lunettes, but in one specimen the slitband is divided by a single delicate raised line, and in several it shows traces of numerous exceedingly minute lines which seem to be interrupted by the much stronger lunettes and confined to the intervals between them.

The transverse lirae on the lateral surface are about like the spiral lirae, rather strong and coarse, and between the two, the lateral surface is divided into rather large rhombic areas. The transverse lirae come to an end at the raised line that forms the upper boundary of the slitband. They are not continuous with the lunettes in the slitband which are in fact much more numerous and more closely arranged. Nor do they account for the crenulations on the lira that bounds the slitband above (when these can be seen at all) for the crenulations are even finer than the lunettes. On the lower surface the transverse lirae are generally finer, more subdued and more closely arranged than they are on the lateral surface. They show considerable irregularity on the same specimen and great variation between different speci-

mens. Compared with the revolving lirae which they intersect, they are less conspicuous; they are also more closely arranged so that the parallelograms which they help to inclose are much longer than they are wide. Here on the lower surface they are associated with growth lines to which they are similar in kind but superior in strength.

In direction, the transverse lirae spread straight out from the suture, but take on a slight backward trend at the angular margin of the tablature that surrounds it, and at the same time they become arched (convex side toward the aperture), so that upon reaching the upper boundary of the slit band their backward direction is very pronounced. The transverse markings on the slit band itself make the usual concave arch. On the lower surface the transverse lines have a gentle backward trend from the periphery and are gently sinuous in shape. Close under the slit band they have a forward direction, but, making a turn on the periphery they first describe a concave curve and then when half-way across, a convex curve. These curves, which are expressed with reference to the outer lip, are very broad and shallow.

In some respects *Orestes? reticulatus* resembles the species which Keyes thought might be the one which Meek and Worthen thought might be Shumard's *Pleurotomaria brazoensis*. Shumard's species, as I interpret it on specimens from Texas, is a characteristic member of the genus *Orestes*, and is very different from Meek and Worthen's shell. The latter must be called *Pleurotomaria intertexta*, a reversional name which those authors suggested in case it proved to be distinct from *P. brazoensis*. *P. brazoensis* of Keyes, on the other hand, seems to be a quite different species from the *P. brazoensis* of Meek and Worthen (or *Pleurotomaria intertexta*) and even more different from typical *P. brazoensis*. Though not identical with *Orestes? reticulatus*, it is much like it in general appearance. Its shape, however, is more turreted and less conical; its slit band is broader, is divided by a median line, and is peripheral in position instead of being above the periphery with a groove below it. The carinae on either side of the slit band are not simple raised lines or ridges—they are compound, the upper being formed by two raised lines and the lower by two or three. Furthermore, the transverse lines are of two orders and so disposed that from three to six of microscopic size intervene between two of the larger ones. Something like this can be observed on the lower surface of *O. reticulatus* though the intermediate lines are subdued and incremental in character, but on the lateral surface, growth lines, if present at all, are only just discernible. Thus, the obvious resemblance between *O.? reticulatus* and the *Pleurotomaria brazoensis* of Keyes is of a general character, and critical comparison discloses many differences in detail.

McCoy formation of Roth (Pennsylvanian); McCoy, Colorado (station 6714).

Orestes? quadrilineatus n. sp.
Figs. 20–22.

In its general character and also in many details this species is closely allied to *Orestes? reticulatus*. It is, however, more depressed and in shape more

or less hemispherical whereas the other is more or less conical. This difference is partly due to the shape of the constituent volutions which are more rounded, and partly to their adjustment to one another. The more rounded shape of the volutions manifests itself in several details. The lateral surface is more arched and at the same time less oblique; the lower surface likewise is more arched, dropping farther below the peripheral zone. The peripheral zone is much less angular, for whereas in *O.? reticulatus* the part below the slitband projects beyond the part above, so as to form a sharply rounded peripheral angle, in this species the two parts project about equally, so that the slitband appears to occur rather upon a broadly rounded peripheral zone than above a narrowly rounded one.

The two species differ perhaps more in configuration than they do in sculpture, but the sculpture too, though the same in general character, is different in certain details. The spiral ornamentation in *O.? quadrilineatus* consists of fewer and sometimes thicker lines more widely spaced and the transverse ornamentation also, though varying greatly in scale, is on the whole somewhat coarser. The lateral surface is commonly marked by 4 strong, sub-angular, revolving costae separated by rounded grooves of much larger size. This enumeration does not include the raised line that bounds the slitband on its upper side, but it does include the ridge that marks the outer limit of the tablature below the suture. These four revolving costae can not be said to have any constant or characteristic arrangement for they vary in spacing from specimen to specimen, but rather commonly the upper one stands some distance from the suture and the intervening surface may, by reason of the rounded shape of the volution, incline slightly downward toward the suture instead of declining slightly away from it. On the other hand the side of the surface may arch inward regularly to the suture without forming any distinct tablature. The lowest of the 4 costae, as a rule, occurs rather close to the slitband, but is separated by a rather broad interval from the one above. The one above (or the third from the suture) may be somewhat smaller than the rest or it may be entirely undeveloped. In that event there would be 3 instead of 4 of these revolving costae. All four, however, may be essentially equal in size and spacing. The transverse lirae instead of tracing a regular backward curve from the suture as in *O.? reticulatus*, reach the same end by an angular change of direction where they cross the spiral ridges, the points of intersection being marked by nodes which though actually small are sometimes prominent and striking. Thus, the shelf-like jutting of the shell below the suture is apt to be conspicuously and handsomely marked by strong lines which spread out from the suture, form pronounced nodes on the revolving ridge that forms its outer boundary, and pass backward by successive angles to the slitband. This shelf-like projection, crossed by transverse lines and bordered by a row of nodes, is in many specimens a conspicuous feature.

O. quadrilineatus is closely related to *O. reticulatus;* the fact of relationship is clear and the degree is not. Taken together a rather large number of specimens have been examined but many of these specimens have been crushed, some completely flattened, so that their original shape at best can only be surmised; to that extent it is impossible to determine how far the differences in configuration and the differences in sculpture above described are parallel developments, especially as the sculpture also is defaced in some specimens.

Judged by such specimens as retain both features more or less faithfully the two species appear to intergrade. Some specimens represent a more or less intermediate condition between the low hemispherical shape distinctive of *O. quadrilineatus* and the high conical shape distinctive of *O. reticulatus*. Again some specimens that in configuration appear to belong with the one species have a sculpture tending to ally them with the other. In fact the sculpture is not at all constant, varying if only in minutiae from specimen to specimen. Yet we have the counter-vailing fact that the low hemispherical shells do generally differ in sculpture as well as in shape from the high conical ones and that the extremes are conspicuously unlike.

McCoy formation of Roth (Pennsylvanian); McCoy, Colorado (station 6714).

Pleurotomaria aspera n. sp.

Figs. 23–25.

Shell small, conical, composed of 6 or 7 regularly enlarging volutions. Spiral angle about 60°. Spire with rather flat sides interrupted by the suture which is indented though not deeply.

Final volution trapezoidal in section with the peripheral line almost basal. The lateral surface is nearly planate, descending steeply from the suture and passing below into the peripheral angle which is narrowly rounded. The basal surface, though nearly flat and nearly horizontal descends slightly from the periphery and bends upward rather abruptly in the axial region. The slit-band is situated on the peripheral angle and the volutions embrace to or almost to its lower boundary. The axis is solid, but the lip appears to be slightly reflexed forming a small indentation.

The sculpture, as is usual in these shells, consists of spiral and transverse lirae but as the lirae are uncommonly strong and coarse for so small a species they give the surface a conspicuously rough appearance. The side of the last volution is marked by 5 or 6 primary lirae which are more or less equal in size and separated by somewhat wider interspaces. The interspaces, like the lirae, vary somewhat in width and one or more of them may be occupied by a secondary lira; thus the sculpture presents great variety in detail. The transverse lirae are not quite so strong as the revolving lirae and they are not quite so far apart. The intersections of these decussating lines are marked by exceptionally large nodes. The nodes are somewhat elongated in line with the transverse lirae which are thin and depressed in the intervals between them. Thus the nodes have a strict linear arrangement in a transverse as well as in a spiral direction. This double alignment is not well shown in the illustrations in which the transverse arrangement is hardly distinguishable while the spiral arrangement is conspicuous. The transverse lirae at the outset are about perpendicular to the suture but in a short distance they bend rather abruptly backward with a gently convex course. The slitband is broad. It is divided by a median lira which is generally stout and strongly nodose, and it is defined above and below by raised lines which are slender and obscurely nodose. If the median lira is large and prominent, as it is in many specimens, it tends to give the periphery an angulated shape. On the other hand, because the median lira is small or for some other reason, the periphery may be strongly rounded instead of angular. As the lirae that bound the slitband resemble the secondary lirae of the lateral surface and

the median lira resembles the primary lirae the slitband is not as well differentiated as it is in many species, being recognizable chiefly by the deflection of the transverse lirae into lunettes, which, as they produce stout nodes upon the median lirae, to that extent disguise instead of distinguish it. The lunettes are strong and rather widely spaced—not quite so widely spaced as the transverse lirae on the lateral surface. On a few specimens the lunettes for some distance near the aperture are feebly developed—scarcely more than growth lines—and in crossing the median lira they produce scarcely more than crenulations. Farther back on the same volution, however, they are strong and nodose.

The markings of the lower surface do not differ materially from those of the lateral surface. The revolving lirae are generally a little more slender and more widely spaced and they are also more regular in size and in arrangement. They are somewhat more numerous (being 8 or 9 in number) but at the same time they cover a wider surface. In comparison with the lateral surface the transverse lirae are decidedly more subdued and more closely arranged, and they are more distinctly subordinate to the associated spiral lirae. The enlargements formed at the intersections are but small, sometimes scarcely appreciable except in the axial region where some of the spiral lirae (rarely more than 2 or 3) are strongly and conspicuously nodose. In direction the transverse lirae have a somewhat backward direction and a slightly sinuous course making close to the slitband a short and gentle convex curve, then a broad and gentle concave curve, and near the axis a second convex curve.

In the earliest volutions on which the sculpture has been observed, it appears to consist entirely of very fine spiral lirae—this refers, of course, to the region above the slitband which is the only part not concealed. Somewhat later transverse lirae become visible though at first they are much subordinate to the spiral ones; still later by a relative increase in strength they become nearly but not quite equal to them.

There are few species in our Carboniferous literature with which *P. aspera* can profitably be compared, those whose sculpture is somewhat similar being mostly much more depressed-conical in shape. *P. granulistriata*, however, is very similar in both shape and sculpture, so much so that selected specimens, though no two have been observed that were even essentially the same in character, might yet be classed as of the same species. The sculpture of *P. granulistriata*, however, is on the whole coarser than that of *P. aspera*, the nodes at the intersections of the decussating lirae are more rounded and prominent and the transverse lirae are less pronounced.

McCoy formation of Roth (Pennsylvanian); McCoy, Colorado (station 6714).

Pleurotomaria woolseyana, n. sp.

Figs. 26, 27.

Shell of medium size, subconical or subovate, somewhat turreted. Volutions about five in number. Spire moderately high with depressed sutures. Aperture subelliptical or slightly rhombic. Axis solid.

The external surface of the final volution is sharply differentiated into three zones—lateral, peripheral, and basal. The narrow peripheral zone

which contains the slitband occurs well below the mid-height. It is approximately parallel to the axis and is either gently concave, when it is defined by slender raised lines, or flattened, when it is defined by distinct angles. The broad lateral surface is moderately convex and declines more or less strongly from the suture. The broad lower surface is almost planate. It has a gentle downward obliquity from the periphery but is strongly upturned in the axial region and also, in some specimens more than in others, near the periphery.

The sculpture comprises spiral and transverse lirae. The spiral lirae occur on both the lateral and the basal surface; the transverse lirae only on the lateral surface. On the lateral surface the spiral lirae are rather strong and closely arranged; they are developed to the number of 10 or 12 and are commonly subequal, though they may irregularly alternate in size. The transverse lirae are apt to be somewhat weaker than the revolving lirae and somewhat finer and more closely arranged. The spiral series shows a gradual increase in scale from the suture to the periphery; the transverse series likewise shows a gradual increase in scale from above downward but also a diminution in strength. The points of intersection of these two series are reinforced as small but pronounced nodes which are distinctly aligned in spiral and transverse rows. Because of the weakening of the transverse lirae in their downward course, the transverse alignment is conspicuous over the upper part of the volution while the spiral alignment alone is distinct in the lowest rows—2 or 3 in number. Sometimes the lirae themselves are inconspicuous but the nodes which they form remain undiminished in strength and in the regularity of their alignment.

The lower surface is marked by revolving lirae, about 12 in number. These lirae contrast sharply with those of the lateral surface in being smooth instead of nodose; as a rule they are also somewhat stronger and more widely spaced. They become more slender and more closely arranged toward the axis. Very fine regular incremental lines are sometimes present and correspondingly fine crenulations are then formed on the revolving lirae; however, even these are rarely to be observed.

The markings of the peripheral zone are delicate and commonly obscure, and they appear to vary from specimen to specimen. The arrangement most often found consists of 3 or 4 equal, closely spaced, revolving lirae without appreciable cross-markings. On some specimens a line having the median position is larger than the rest, and on some only a single line, corresponding to this one, can be made out. The median lira, whether alone or accompanied by others, may be periodically enlarged into minute, beadlike nodes; for any other manifestation of transverse lines, however, one looks almost in vain. There is, however, convincing evidence, both from analogy and occasional observations, that the peripheral zone with its specialized sculpture is the site of the slitband.

The volutions embrace up to the lower border of the slitband, and as the volutions are more or less convex while the band is vertical in direction besides being more or less concave, the suture is correspondingly indented and the spire correspondingly turreted.

In the figured specimen the nodes above the slitband appear to be arranged in spiral lines only, especially the two lowest. Over the upper part of the volution the dual alignment is conspicuous. In fact, certain lights bring out a reversed alignment across the surface. The normal transverse alignment (from the suture downward and to the right) is not adequately shown

by the figure which also is on too small a scale to show the minute nodes on the median lira of the slitband.

P. woolseyana is related, though somewhat distantly, to *P. granulistriata*. It is much larger, the largest of my specimens being 11 millimeters in height and 9.5 millimeters in diameter. Meek and Worthen's species is only about half as large and it also seems to be more constant in its slender conical form. The surface markings of both are the same in general plan, but those of *P. woolseyana* are finer, especially in relation to the size of the shell, and more subdued; 10 to 12 revolving lirae occur on the upper surface as against 3 or 4 in *P. granulistriata*, the lirae on the under side being also more numerous. The lirae of the lower surface are in this species a little larger and more widely spaced than those on the upper, which is just the reverse of the condition described by Meek and Worthen. Furthermore, the slitband in *P. granulistriata* is marked by sharply defined lunettes and is occupied in large part by a single revolving lira that is strongly and somewhat coarsely nodose.

P. woolseyana is much more closely related to *P. millegranosa* besides occurring in the same fauna. The most pronounced difference perhaps is that the slitband in *P. millegranosa* regularly carries a single revolving line that is strongly nodose, whereas the slitband in *P. woolseyana* has from 1 to 4 revolving lines that are not nodose or are but partly so; this difference, however, is but a general tendency, not invariably pronounced. Again, in *P. millegranosa* the sculpture of the lateral surface is coarser, the nodes are larger, and their arrangement in spiral lines, more conspicuous—or at least an arrangement in transverse lines is less so.

Brentwood limestone member of the Bloyd shale (early Pennsylvanian); bank of stream about 1¼ miles south of Woolsey, Arkansas. Winslow quadrangle (station 2849).

Pleurotomaria millegranosa n. sp.
Figs. 28, 29.

Shell small, subconical, composed of 5 or 6 volutions. Height and width about equal. Suture depressed.

Final volution somewhat rhomboidal in section with the periphery well below the middle. The lateral surface is strongly oblique and gently convex, slightly prominent close to the suture; the lower surface is almost planate and almost horizontal but is strongly upturned to the axis. The lateral and lower surfaces meet in a rounded peripheral angle about two-thirds of the entire height of the volution below the suture. The peripheral angle is indented by the slitband which is defined by two slender sharp revolving lirae of equal size and prominence. The volutions embrace about to the lower boundary of the slitband which, rising sharply above the suture, gives the spire a slightly turreted shape.

The sculpture varies considerably, but that of the lateral surface in general terms consists of 7 to 9 revolving lirae surmounted by rounded nodes regularly spaced at about their own diameter. The lirae are on the whole equal in size and regular in arrangement, but they are commonly a little

finer and more closely arranged above, near the suture, and a little coarser and more widely spaced below, near the slitband. For a short distance below the suture the nodes have a transverse as well as a spiral arrangement.

The lower surface is marked by from 7 to 13 slender, sharply elevated revolving lirae separated by flattened interspaces. In contrast to those of the lateral surface, these lirae are smooth, devoid of nodes or even, as a rule, of crenulations. Toward the axis, they do not so much diminish in size as in spacing, the interspaces near the periphery being somewhat wider than the lirae, those near the axis somewhat narrower.

The slitband, as already described, is a narrow sulcus indenting the peripheral angle and defined by two slender lirae. These lirae are smooth and knife-edged. The upper one contrasts strongly with the nodose lirae just above; the lower one, on the contrary, rarely differs appreciably from the lirae of the lower surface except that it is so situated and directed as to make the lower surface appear to terminate there in a sharp angle. The slitband is regularly divided by a slender median lira formed of small, closely arranged nodes. Though resembling the lirae of the upper surface in its moniliform shape, this lira is more slender and more finely nodose.

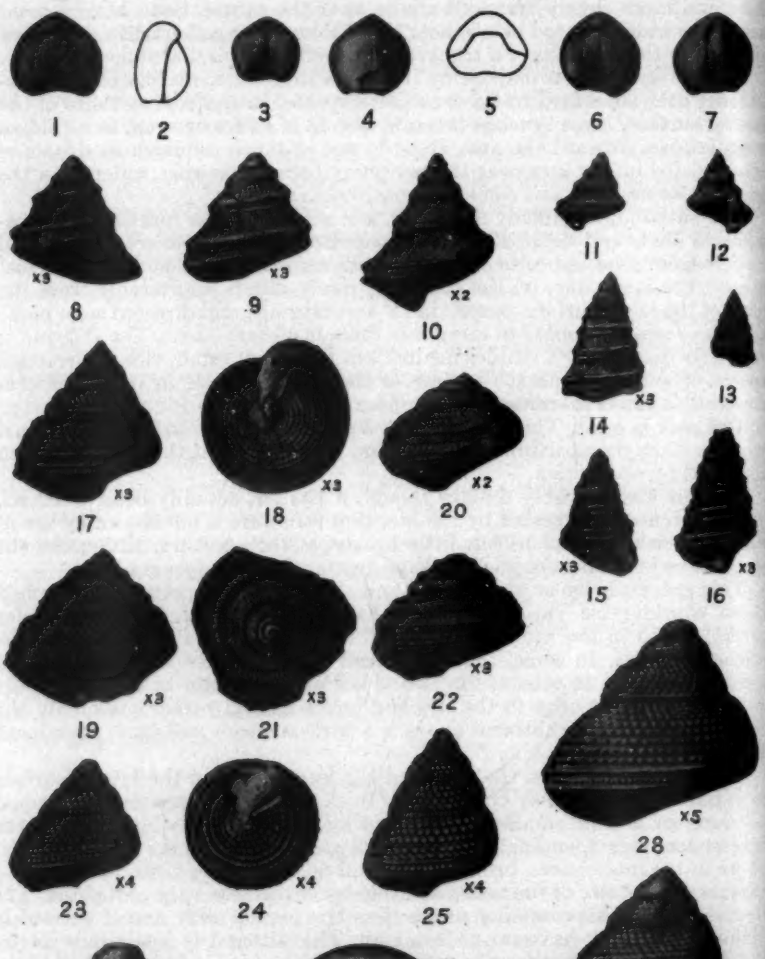
The axis is solid. There is no inner lip; instead, the surface of the final whorl within the aperture is smooth and depressed as if the shell had been removed by absorption.

The slit was probably shallow though it has not actually been observed. This inference is suggested by the fact that structure is not shown by specimens which appear to be but little broken at the aperture. Either the slit must have been short or the breakage greater than it appears to be.

This species is by no means rare and the numerous specimens examined show considerable variation. Shells have been referred here that differ notably both in the width of the spiral angle and in the shape of the constituent whorls. In some, the lateral and lower surfaces of the whorls are less arched than in others; the lateral surface may flare in the lower part with a prominent edge to the slitband below it; and rather commonly the lira that bounds the slitband above is a little stronger and more prominent than the one below it.

The relation between the lirae and the interspaces on the lateral surface is variable; the lirae may be relatively thick and the interspaces about equal to them or a trifle smaller; or the lira may be relatively slender and the interspaces correspondingly broad. Small accessory lirae may occur here and there in the interspaces, bringing the total number up to 12 or more in some instances. The size of the nodes and the size of the lirae vary pari passu. The accessory lirae have smaller nodes than the regular lirae and if extremely slender they may have no nodes at all. The slitband is sometimes distinguished not only in the ways mentioned, but also by being isolated, the interval between it and the lowest lira above being as wide as the slitband itself and much wider than the interval between any of the nodose lirae. On the other hand, this interval may be occupied by a slender accessory lira. The relation between the lirae and interspaces varies also on the lower surface, some specimens having slender lirae with relatively wide interspaces, others relatively thick lirae with narrow interspaces.

The nodose character of the revolving lirae is virtually due to slender transverse ridges developed at short and regular intervals which, on crossing the revolving lirae, greatly strengthen them. These transverse elements are rarely to be distinguished as ridges except below the suture; elsewhere they



Figs. 1–29.—For explanation see opposite page.

are almost without visible evidence save that which is furnished by the nodes. Consequently, the spiral arrangement of the nodes is conspicuous, the transverse arrangement readily overlooked. Nevertheless such an arrangement must be present if the nodes are formed in the manner indicated, and in fact, upon close observation, transverse rows can be distinguished, curved and backward sloping. Except near the suture and for occasional prolongations, very subdued, the transverse ridges do not appear elsewhere on the older volutions. They are suggested, it is true, by the nodes on the median lira of the slitband, but the slitband rarely shows any evidence, even obscurely, of the sharply defined lunettes characteristic of that part, whereas the lower surface commonly appears to lack even growth lines.

With well preserved specimens and with a favorable light, the nodes on the lateral surface are seen to have the form of arched scales rising obliquely toward the aperture and in general appearance they may be likened to a series of minute funnels issuing one from another. They appear to be produced by transverse lamellae that are extended and thickened where they cross the revolving lirae. On the same specimen, but with a change of light these projections look like well defined rounded nodes, and that is how they usually appear.

As the shell progressed toward maturity the volutions underwent a change both in shape and in sculpture. The immature whorls were essentially circular in section, but the later ones became flattened on the outer side obliquely and on the under side horizontally until they became more or less rhombic in section. The immature sculpture was characterized by a greater balance between the transverse and spiral markings. At a stage preceding that characterized by a mature type of sculpture the transverse lirae and the spiral lirae appear to have been of about equal strength. Not un-

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Description of figures

The figures on this plate are of natural size unless otherwise stated.

Figs. 1–7. *Cryptacanthia? robusta* n.sp. Different views of 4 cotypes. Figs. 1–2. Dorsal and side views of a large specimen somewhat worn down the middle of the pedicle valve. Fig. 3. Dorsal view of a small specimen. Fig. 4. Ventral view of another specimen. Figs. 5–7. Anterior, dorsal, and ventral view of a fairly complete specimen. Delaware Mountain formation, Culberson County, Texas (station 6452).

Figs. 8–9. *Pleurotomaria worthenioides* n.sp. Two views of the holotype, ×3. Brentwood limestone, Winslow quadrangle, Arkansas (station 3733).

Figs. 10–12. *Euconospira hermosana* n.sp. Three views of the holotype, figure 10 being ×2. McCoy formation of Roth, McCoy, Colorado (station 6714).

Figs. 13–16. *Pleurotomaria rockymontana* n.sp. Views of 4 cotypes. Figures 14–16 are ×3. McCoy formation of Roth, McCoy, Colorado (station 6714).

Figs. 17–19. *Orestes? reticulatus* n.sp. View of 2 of 4 cotypes. ×3. The specimen represented by figure 19 is not only crushed, but as drawn is somewhat tilted, giving a false impression of the configuration in several respects. The under side is really almost flat and almost horizontal, as in figure 17. McCoy formation of Roth, McCoy, Colorado (station 6714).

Figs. 20–22. *Orestes? quadrilineatus* n.sp. Views of 3 of 4 cotypes. Fig. 20 is ×2, the others ×3. McCoy formation of Roth, McCoy, Colorado (station 6714).

Figs. 23–25. *Pleurotomaria aspera* n.sp. Views of 2 of 4 cotypes. ×4. Figures 24 and 25 represent the same specimen. McCoy formation of Roth, McCoy, Colorado (station 6714).

Figs. 26, 27. *Pleurotomaria woolseyana*, n.sp. Views of 1 of 7 cotypes, ×5. The median lira of the slitband is marked by minute nodes, too small to be represented on the drawing. Brentwood limestone, Winslow quadrangle, Arkansas (station 2849).

Figs. 28, 29. *Pleurotomaria millegranosa* n.sp. Views of 2 of 7 cotypes, ×5. Brentwood limestone, Winslow quadrangle, Arkansas (figure 28, station 3733; figure 29, station 3662).

commonly the upper half of the volution will appear to be marked by transverse lirae rendered irregular or nodose by the spiral lirae while the lower half appears to be marked by spiral lirae rendered regularly nodose by the transverse lirae. At one stage, probably just prior to the stage just described, the surface is marked by smooth spiral lirae of considerable strength and at a stage still earlier by minute irregular spiral striations. The earliest stages were presumably smooth or marked only by incremental lines.

These specimens show a feature which they share with many other gastropods, but which cannot be accounted for in any acceptable way. I refer to small round openings or perforations which are obviously superficial as regards penetration, fairly uniform in size, and fairly regular in distribution. That is, although they are found only on certain specimens and on certain parts of others, they almost invariably occur on the tops of the nodes or on the crests of the lirae. They can hardly be attributed to a boring organism or on the other hand to abrasion. It is conceivable that they may be due to some peculiarity of structure or to some peculiarity of chemical composition (perhaps related to the pigments that produced color markings) and that variation in this feature was played upon by varying forces in process of fossilization. As this phenomenon is so common it is mentioned here only because it sometimes lends a fictitious appearance to those lirae of the lower surface which are described as smooth and even, but are in this way made to appear ragged or nodose.

P. millegranosa was found in considerable abundance at station 3662 and station 3733, and a single characteristic specimen was found at station 1996d. Elsewhere the species appears to be rare and the other specimens referred here are few, immature, and more or less ill-preserved. Their identification is correspondingly qualified.

Pleurotomaria millegranosa resembles Meek and Worthen's *P. granulistriata* from which, however, it differs considerably in several particulars. The whorls in *P. granulistriata* appear to be more regularly rounded and the lateral surface is traversed by only 3 or 4 revolving lines, whereas *P. millegranosa* has twice that number. The transverse lines which in both species help to produce the granules on the revolving lirae are in *P. granulistriata* more pronounced; in the present species the granules (except in young specimens) rarely show much transverse connection and are predominantly spiral in their arrangement. Furthermore in *P. millegranosa* the lower surface has somewhat more numerous revolving lirae and it is also without cross striae. These differences and others show clearly that *P. millegranosa* is a distinct species. It is also distinct from the one which I have called *Pleurotomaria woolseyana*, though an undoubted resemblance exists between them. The slitband in *P. millegranosa* is narrower and more sharply defined and it is traversed by a single lira which bears regular nodes instead of several smaller lirae which commonly are without them and the lateral surface is even less conspicuously marked by transverse lirae.

Brentwood limestone member of the Bloyd shale (early Pennsylvanian); S.W.¼ sec. 27, T.13N., R.32W. (station 3733); up draw from Cove Creek, 3 miles north of Cold Spring, Arkansas (station 3662). Winslow quadrangle.

ZOOLOGY.—*A new pocket mouse from Sonora.*[1] E. W. NELSON, U. S. National Museum and E. A. GOLDMAN, Biological Survey.

Among the results of the Mexican expedition of Frederic Winthrop in cooperation with the Biological Survey in 1932, was the collection of a specimen of *Perognathus flavus* in Sonora. The known range of the species is thus materially extended into the low desert region near the shore of the Gulf of California. The single specimen collected appears to represent a new and easily recognizable geographic race here described.

Perognathus flavus sonoriensis, subsp. nov.
Sonora Pocket Mouse

Type.—From Costa Rica Ranch, lower Sonora River, Sonora, Mexico. No. 250885, ♀ adult, skin and skull, U. S. National Museum (Biological Survey collection), collected by Vernon Bailey and Frederic Winthrop, December 13, 1932. Original number 11282.

Distribution.—Low desert plains of middle western Sonora.

General characters.—Closely allied to *Perognathus flavus flavus*, but upper parts less heavily overlaid with black, owing to shortening of dark tips of hairs; ears less blackish; black facial markings obsolescent; hind foot apparently shorter; cranial details distinctive.

Color.—*Type:* Upper parts in general near pinkish buff (Ridgway, 1912), finely mixed or overlaid with black, the dark hairs most numerous on top of head and over back; lateral line rich pinkish buff, broad and distinct from cheeks to thighs, with a narrow downward extension reaching to near forearm; under parts and limbs white; muzzle white; dark, V-shaped, facial marking narrow and indistinct; ears lined internally with mixed grayish and brownish hairs; tail dull whitish, nearly unicolor.

Skull.—Very similar to that of typical *flavus*, but rostrum and nasals shorter; zygomata more widely spreading anteriorly; molariform teeth smaller.

Measurements.—*Type:* Hind foot, 15 mm. (no other external measurements available). *Skull* (type): Length (median line), 19.3; greatest breadth (across audital bullae at meatus), 11.7; zygomatic breadth (posteriorly), 10.3; interorbital breadth, 4.2; length of nasals, 6.5; width of nasals (in front of incisors), 2; interparietal, 3×3.2; maxillary toothrow, 2.8.

Remarks.—*P. f. sonoriensis* requires close comparison only with typical *flavus* of western Texas. Vernon Bailey reported that the specimen made the type "was found dead, drowned after the big rain of December 14, near our camp on the big flat at the sink of the Sonora River." In regard to the general occurrence of the animal he says: "On the big sandy mesquite plains near Llano they were especially numerous and dozens of their characteristic little round burrows and little hills of earth were all around our camp . . . but the mice refused our bait. One left his tail in a trap which showed the species if not the subspecies. Other places where signs were seen were near Hermosillo and Magdalena."

[1] Received March 14, 1934.

ENTOMOLOGY.—*The genus* Oliarus *and its allies in North America (Homoptera Fulgoridae).*[1] E. D. BALL, University of Arizona.

The writer started to prepare a food plant list of the western waxhoppers of the Fulgorid family *Cixidae* but soon found that, as usual, a considerable number of the species had apparently not been named. As opportunity afforded he has been taking up one genus at a time for preliminary revision in order to assign the new forms to their proper positions. One form was found that did not fit into any existing genus and the following genus is proposed for its reception.

Oliaronus Ball n. gen.

Intermediate in size and form between *Mnemosyne* and *Oliarus*. Resembling a large dark *Oliarus* with an extremely broad head and long, narrow, almost parallel margined elytra. Vertex very broad, but little longer than broad, almost parallel margined, the lateral carinae angled just in front of the middle and uniting before the apex, forming two large fovae. Front tumid, rounding over to vertex with only a trace of a carina, broad at the base and narrowly clasping the extremely long, oval, tumid clypeus. The ocellus visible and a median carina on front and clypeus indicated. Pronotum as short or shorter than in *Oliarus*, deeply angularly emarginate posteriorly and projecting into the angularly emarginate head. Mesonotum faintly 5 carinate. Elytra long and narrow with a smoky subhyaline membrane and strong dark nervures that are heavily setigerous throughout. Venation striking and distinctive. The subcosta (+R) approaching the costa which is thickened back to the stigma and the whole thickened area thickly beset with heavy setigerous punctures. The area between the subcosta and medius with scattering punctures in the central part. The stigma located anterior to the end of the clavus, the subcosta and radius both turning in, the subcosta capturing the radius about half way back from the stigma and thus forming a very broad area along the costa, which is divided into from 8 to 10 long narrow transverse cells. The female abdomen with a large wax plate.

Type of the genus *Oliaronus tontonus* n. sp.

Oliaronus tontonus Ball n. sp.

Superficially resembling *Oliarus pima* Kirk, slightly longer and narrower, much darker and more heavily setigerous; with a series of transverse veinlets back of the stigma. Length ♀ 10 mm, ♂ 8 mm, width ♀ 3.5 mm.

Structure of the genus, the vertex almost square, rounding over in front, face much narrower than in *O. pima* and more tumid. Pronotum very short, not more than half the length of that in *pima*, the carina closely margining the eyes. Elytra long, narrow, and appressed, the apical third slightly expanded, the costal margin with a slight angle near the base, the costal area back of this very narrow, darkened and heavily pustulate. The stigma very short and placed far forward, only a little farther from the base than the apex. Behind this in the expanded area are 8–10 long narrow transverse cells becoming more oblique as they approach the apex.

[1] Received February 28, 1934.

Color, dark smoky brown, the face, margins of vertex and often the mesonotal tablet testaceous; elytra smoky, the nervures black.

Holotype ♀, allotype ♂, and 10 paratypes Eloy, Ariz., Aug. 5, 1932, one Cline, Ariz. Aug. 2, 1929, all taken from mesquite by the writer; one paratype, Florence July 25, 1932 (Parker). The transverse cells in the expanded margins of the elytra will at once distinguish the species.

Genus Oliarus Stal

The genus *Oliarus* was a difficult one for all early American workers because the amount of material available was very limited and fragmentary, many species being represented by a single individual or a single sex and good series from a single food plant unknown. Five species were named by the early workers. The writer described three western species in 1902. Fowler in the Biologia (1904) described nine new species without recognizing any of those previously described. His material was very limited, half of the species being described from a single sex. Van Duzee reviewed the United States forms in 1908 with the first key and added several species in 1912, and others later. Metcalf (1923) keyed out the species of the eastern United States and added four more.

The writer has been collecting material and attempting to determine food plants during the thirty years since his first paper, and now has good series of twenty-three and representatives of three others of the twenty-eight species here recognized as occurring north of the Mexican border. A study of long series of a number of species has brought out the fact that in this genus the females may be transversely banded, striped, or spotted but the corresponding males are nearly always plain or nearly so. This has not been previously recognized and has led to much confusion and synonomy.

A careful study of Fowler's descriptions and figures suggests the following disposition of his species; *O. excelsus* belongs to the *vicarius-placitus* group but cannot be placed accurately until a male is found. It appears to resemble *placitus* Van D. and examples of that species are at hand from Brownsville, Tex. *O. concinnulus* appears to be a distinct species occurring in the U. S. *O. propior* seems to be a distinct species of the broad headed group; the figure shows an extremely broad face. *O. lacteipennis*, poorly described without sex is apparently *complectus* Ball (1902). *O. humeralis*, equally poorly described from a female, is probably the same. *O. breviceps* described from a female is *aridus* Ball (1902) which occurs commonly around the Gulf. *O. chiriquensis* and *insignior* belong to the genus *Myndus* and are apparently distinct species in that group. *O. nigro-alutaceus* is a distinct species occurring north into Arizona.

Metcalf (1923) did not recognize the difference in color between sexes which is so striking in this group, nor did he consider the Fowler species and as a result redescribed *concinnulus* Fowl. as *texanus* from Brownsville. The writer took a good series there in Jan., 1932. Fowler's drawing of the genitalia is much better than Metcalf's figure. Metcalf apparently misidentified *diffi-*

cilis Van D. which was described from two females, as he figures the male genitalia as of the "hammer" type. The writer collected in central and southern Florida and at Brownsville, Tex. a small pale species the female of which exactly fits Van Duzee's description of *difficilis* and the male of Metcalf's description of *vittatus* (holotype male) from Brownsville. The allotype ♀ of *vittatus* described with the broad vitta was the female of *texanus* (which = *concinnulus* Fowl.), while the true female of *vittatus* (which = *difficilis* Van D.) has the remnants of a transverse band as described by Van Duzee.

PRELIMINARY KEY TO THE SPECIES OF OLIARUS

A Female with more or less definitely transversely banded elytra (often three dashes on costal area). Verticies rather long, narrow, deeply sunken between high lateral carinae that are alternately light and dark. (Male genital projections sometimes greatly enlarged at apex.)

B Male genital projection enlarged, plates hammer like.....(Fla. Tex.) 1. *placitus* V.D. (N.C.) 2. *montanus* Metc.

BB Male genital projection triangular.

C Nervures all heavily dotted. Species large.....(SE) 3. *vicarius* Wk. (NE) 4. *quinquelineatus* (N.C.) 5. *vitreus* Metc.

CC Nervures on the basal half of elytra pale, punctures scarcely showing. Species small.....(Fla. Tex.) 6. *difficilis* V.D. (Fla.) 7. *chuliotus* Ball

AA Females with markings on elytra more or less linear (or oblique) or obscure (no dashes along the costal area, *exoptatus* excepted). Vertex variable, often broad and shallow, male genital projection never enlarged.

D Species broad, often short and broad, the vertex as broad as long or not over one third longer than broad.

E Elytra smoky. Females often with dashes along costa and occasionally a transverse band.

F Elytra uniformly smoky, face definitely carinate.....(NW) 8. *exoptatus* V.D.

FF Elytra deep smoky, twice interrupted with white. Face tumid, polished.....(Ariz.) 9. *papagonus* Ball

EE Elytra hyaline, costal area immaculate.

G ♀ 8–10 mm. Elytra milky, the nervures darkened but scarcely punctured.

H ♀ 10 mm. Elytra with markings.....(Ariz.) 10. *pima* Kirk

HH ♀ 8 mm. Elytra more or less ornamented.....♀(Ariz.) 11. *nogalanus* Ball (South) 12. *aridus* Ball

GG ♀ 7 mm. or less. Elytra various.

I General body color dark.

J ♀ with a heavy zig zag pattern on elytra.....(SW) 13. *californicus* V.D.

JJ ♀ almost unmarked.

K Face tawny with large spots.....(Western 14. *hesperius* V.D. (Calif.) 15. *truncatus* V.D.

KK Face black, unmarked. Stigma small.....(Calif.) 16. *fidus* V.D.

II General body color tan or lighter.....(Colo.) 17. *sementinus* Ball

DD Species more or less elongate, the vertex more than ½ longer than broad.
L Elytra hyaline or subhyaline, not deeply smoky.
M Body dark (or brown). The nervures dark or dark punctured.
N Elytra with the apical nervure and margin concolorous with the adjoining nervures.
O The nervures of the elytra only faintly or sparsely dotted or else the nervures dark so that the punctures are obscure.
P Front more than twice as broad across the antennae as at base. Faun colored with a pair of yellow spots. Large.....(Fla.) 18. *slossoni* V.D.
PP Face much narrower, not twice wider on antennae than at base, dark with the carinae light.
Q Large (3 mm. broad) Dark with the nervures dark throughout.....(Ariz.) 19. *corvinus* Ball
QQ Smaller (2 mm. broad) paler or dark with the nervures pale.
R Spine of anal segment of ♀ produced into an acute point extending into the genital cavity, 3rd anteapical cell wanting, the fourth very broad at apex.....Subtropical) 20. *complectus* Ball
RR Anal segment of male without a spine extending into genital cavity.
S 6 anteapical cells, the third but little longer than wide.....(Ariz.) 21. *yavapanus* Ball
SS 5 anteapical cells the third wanting.....(Ariz.) 22. *coconinus* Ball
OO The nervures at the base of the elytra pale, heavily and evenly dotted.
T Elytra slightly tawny or smoky, the dots and cross nervures not prominent.....(Fla.) 23. *littoralis* Ball
TT Elytra hyaline with heavy dots and cross nervures.
U Vertex broad at base, the lateral fovae not half its length.....24. *concinnulus* Fowl.
UU Vertex narrow, the lateral fovae more than half its length.....(Ariz. & Mex.) 25. *apache* Ball
NN Elytra with the apical margins narrowly ivory; the nervures, at least on the apical portion, dark with heavy bristles.....(Ariz.) 26. *altanus* Ball
MM Body tawny, the nervures pale except at apex.....(Arid W.) 27. *dondonius* Ball
LL Elytra deep smoky or black, or at least the apical third dark.
V Elytra all smoky.
W Small (not 2 mm. wide) costal margin of elytra dark.....(SW & Mex.) 28. *nigro-alutaceus* Fowl.
WW Large (4 mm. wide) costal margin narrowly white.....(North) 29. *cinnamomeus* Prov.
VV Apical third of elytra deep smoky.....(North) 30. *humilis* Say

Oliarus chuliotus Ball n. sp.

Size and form of *difficilis* Van D. nearly, slightly smaller and decidedly whiter. Length 4.5–5 mm.

Vertex slightly longer and narrower than in *difficilis*, the front much nar-

rower with the basal fork of the carina subobsolete, the front slightly longer than the clypeus, while in *difficilis* it is reversed. Mesonotum with the five carinae distinct, while *difficilis* shows only three. Male styles short and stout with a stout hook at right angles extending one third of their length beyond the short pygofers. In *difficilis* the styles are longer, the hooked portion shorter and stouter and the whole not extending beyond the elongated pygofer margins.

Color pale cinnamon brown above and below; the face without white spots, an elongated white spot on the carinae of vertex, the anterior fovae black, a dark brown area outside the lateral carinae of mesonotum. Elytra milky subhyaline over a dark abdomen; the apical third slightly smoky with the transverse nervures infuscated with brown; sometimes a brown cloud inside the stigma. In the females, an elongated black spot back of the middle of the commissure.

Holotype ♀ April 17, 1927, allotype ♂ Apr. 18, 1927, paratype females Apr. 17, 1927, and Apr. 15, 1928, all taken by the writer at Sanford, Fla. A female, Homestead, Fla., May 15, 1928. A male, Eustice, Fla. Apr. 6, 1926, taken by the writer and a male, Haw Creek, Fla., Oct. 8, 1887. Strikingly distinct in color and genitalia.

Oliarus papagonus Ball n. sp.

Resembling *exoptatus* Van D. but slightly smaller, darker with rather indefinite white bands across the elytra. Elytra smoky, face and mesonotum black, polished with the carinae obscure. Length 4–5 mm.

Vertex narrower than in *exoptatus* or *fidus* Van D., a little longer than wide, parallel margined instead of broadening behind as in those species. The basal tablet of vertex narrow and forming a long oval in front, instead of very broad and almost truncate before the tumid apex as in the species mentioned. The whole face evenly convex, polished with the carinae almost obsolete. Mesonotum broad, tumid, polished with obscure carinae. Elytra broad, short, with prominent nervures and heavy setigerous bristles. Male styles with the reflexed portion little wider than the shank and only slightly exceeding the pygofers, the dorsal membrane broad and elevated into a roof-like structure over the styles.

Color, dark smoky, with indistinct white bands across the elytra. Face and mesonotum shining black, the latter margined outside with white. Vertex dark, the carinae rather broadly light.

Holotype ♀, allotype ♂, and 13 paratypes Eloy, Ariz., June 3, 1933, all taken by the writer from a few mesquite trees growing in an area where *Lycium sp.* was abundant.

Oliarus nogalanus Ball n. sp.

Smaller and narrower than *pima* Kirk, the female more definitely ornamented, resembling *aridus* Ball but darker and more slender, much more heavily clothed with setigerous bristles than in either of the others. Length 6–8 mm., width 2 mm.

Vertex, within the carinae and omitting the fovae, as long as wide instead of wider than long as in *aridus* or nearly twice wider than long as in *pima*. Face slightly narrower than in *aridus*. Male styles with the shanks narrow and the hooked portion broad and roundingly right angled, extending considerably beyond the short rounding lateral margins of the pygofers. The dorsal membrane very short and rounding with a slight elevation in the

center. In *aridus* the styles are acutely angled, the pygofers long and the dorsal membrane projects in a long triangle, while in *pima* the hook is still thicker and the dorsal membrane is both longer and broader.

Color brown; a pair of creamy spots on margins of face just below the antennae; the carinae of vertex and pronotum white, elytra in female slightly milky, the nervures dark, the bristles darker, with the forks and cross nervures marked with smoky, which in heavily marked individuals coalesces into two oblique bands toward the apex.

Holotype ♀, Nogales, Aug. 7, 1932, allotype ♂, Santa Rita Mts., July 19, 1931, and 14 paratypes taken with the types and from Douglas, Patagonia and Tucson. All taken by the writer in the mountains of Arizona.

Oliarus corvinus Ball n. sp.

Resembling *complectus* Ball, but larger and darker with heavy pilosity. Black with the carinae orange. Length 5–6 mm.

Vertex relatively long and narrow with the fovae long, slender, reaching the middle of vertex. Base of front narrower and more heavily carinate than in *complectus*. Pronotum larger and more heavily carinate than in *complectus*, elytra longer with the nervures darker and more heavily clothed with setigerous punctures. The third anteapical either reduced or wanting, the fourth about as wide as the adjoining cells instead of much wider as in *complectus*. Male styles stout, the hook broad, evenly rounding, exceeding the truncate pygofers by nearly their width. Dorsal hood moderately broad and almost evenly rounding except for a slight central depression, instead of rather narrow and acutely produced into the genital cavity as in *complectus*.

Color black, all carinae broadly orange. Elytra hyaline or slightly smoky, the nervures dark and heavily clothed with dark hairs. Genitalia cinnamon.

Holotype ♀, allotype ♂, and 12 paratypes, Patagonia Aug. 8, 1932. This species is widely distributed in southern Arizona and is easily distinguished by its size.

Oliarus complectus Ball

O. complectus Ball Can. Ent. **34**: p. 152. 1902.

(*O. lacteipennis* Fowl. Bio. Cent. Am. Homop. Vol. 1, p. 93. 1904)

(*O. humeralis* Fowl. op. cit. p. 94)

(*O. franciscanus* V.D. Cat. p. 732 [Not Stal])

This species was described from 25 examples from Haiti, Md., Kans., Ariz., and Colo. The present study brings out the fact that there were at least two and probably three species included in the original material. In order to definitely limit it to the species intended in the original description, the holotype is fixed on a female from Port Au Prince, Haiti, and the allotype on a male from the same place, both examples so labeled and in the author's collection.

Thus limited the species may be known by the fact that the anal segment projects down into the genital cavity in the form of a median spine. Examples are at hand from Haiti, many places in Florida, southern Arizona and adjacent Mexico. Van Duzee places this species as a synonym of *franciscanus* of Stal, largely on size and distribution no doubt, as Stal's description is

purely generic. As there are at least four species treated in this paper that would meet these requirements, it seems best to consider Stal's species as unknown until such time as our west coast forms are better known and Stal's type can be critically studied.

Oliarus yavapanus Ball n. sp.

Resembling *complectus* but with a narrower vertex, and 6 anteapicals, paler with smoky elytra. Length ♂ 4 mm.; ♀ nearly 6 mm.

Vertex twice longer than wide, the fovae scarcely half its length, the lateral carinae high, almost foliaceous. In profile the vertex and face form a slightly obtuse angle. Mesonotum with five definite carinae, the inner pair strongly sinuate and together with the outer pair enclosing an oval compartment posteriorly. Elytra long and slender, six apical cells the third little longer than wide. Male with the anal segment forming a narrow and uniformly rounding hood back of the long, narrow, angularly hooked, dark brown styles.

Color dark brown to black, the carinae broadly orange, elytra slightly smoky in females, rarely so in the males. The darkening emphasized on the apical cells. The nervures distinctly but not conspicuously punctured. The stigma not as prominent as in *complectus* or *corvinus*.

Holotype ♀, allotype ♂, and a pair of paratypes, Ashfork Aug. 16, 1929, six paratypes Ashfork July 15, 1929, three Yarnell Heights July 21, 1929, and two from the same place Aug. 20, 1929. All collected by the writer from the higher table lands or mountains of Arizona.

Oliarus coconinus Ball n. sp.

Stouter than *complectus* Ball, resembles *yavapanus* Ball, but with a broader vertex and only five anteapicals. Female elytra heavily smoky posteriorly; male hyaline. Length ♂ 4.5 mm.; ♀ 5.5 mm.

Vertex broader behind than in *yavapanus* especially in the female. In profile the vertex meets the front in a right angle. Elytra long and slender with five anteapical cells, the fourth scarcely broader than the others, the stigma elongate. Male anal hood broad on the lateral margins, deeply emarginate medially, where it is distant from the short, stout, bright yellow styles that terminate in round slightly divergent plates.

Color dark brown or black, the carinae narrowly orange. Elytra smoky in the female especially on the transverse nervures, hyaline in the male, nervures dark, sparsely and inconspicuously ornamented with setigerous punctures. A dark line along the median portion of the sutural margin.

Holotype ♀, allotype ♂, and one male paratype Williams July 13, 1929, a female Aug. 15, 1929, a female Flagstaff Aug. 7, 1929, and two males Huachuca Mts., Aug. 2, 1931, all taken by the writer from the table lands or mountains in Arizona.

Oliarus littoralis Ball n. sp.

Form of *complectus* Ball nearly, slightly shorter and stouter, resembles *sementinus* Ball in form and color, but with a much longer, narrower head. Pale brown with the carinae light; elytra pale tawny with the nervures punctured and darker towards apex. Length 4.5 to 5.5 mm.

Vertex and mesonotum about as in *yavapanus* Ball, the elytra with six anteapicals, punctures on nervures strong and extending almost to base.

Male anal segment broad and emarginate as in *coconinus* Ball, the styles stout with long angularly reflexed heads.

Color, pale tawny; the vertex and mesonotum pale to dark brown with the carinae broadly light. Front and clypeus dark brown or darker, but with the carinae broadly light. Elytra tawny subhyaline, the nervures pale tawny and heavily punctured to the cross nervures beyond which they shade to smoky.

Holotype ♀, allotype ♂, and seven pairs of paratypes taken by the writer at Tampa, Fla. Sept. 10, 1927. This tawny species resembles *dondonius* but is much darker, with the styles broader and more hairy, the hood with the lateral flaps overhanging the genital chamber, while in *dondonius* the hood is only a marginal line. Besides the type set, the writer has taken this species in a number of places along the east coast of Florida.

Oliarus concinnulus Fowler

O. concinnulus Fowl. Bio. Cent. Am. Homop. Vol. 1, p. 92. 1904.
(*O. texanus* Metc. Journ. El. Mitch. Sci. Soc. **38**: 181. 1923)
(*O. vittatus* (♀) Metc. Op. cit. 181. [Not holotype ♂])

This is a short broad species, (4–6 mm.), but the vertex is more than ½ longer than its width. The elytra are milky with heavily punctured nervures, pale at the base but becoming dark beyond the cross nervures. The stigma is large and there are usually two black spots in an oblique line from it to the scutellum. The female often has a broad, longitudinal, slightly interrupted stripe near the inner margin of each elytron.

Habitat, Vera Cruz and Guerrero, Mexico (Fowler) and Brownsville, Texas. Fowler suggested that this species may have to be referred to *O. lunatus* Fab. as represented by material which the writer sent him. That material, however, represents a very distinct species.

Oliarus apache Ball n. sp.

Resembling *concinnulus* Fowl. in size and form, darker with a narrower vertex. Black with the carinae on head narrowly light. Elytra milky with close set, black punctures, each bearing a long curved black hair. Length 4–6 mm.

Vertex much narrower than in *concinnulus*, the fovae long, extending more than half way to base. Mesonotum with three, heavy, parallel carinae, the intermediate pair only faintly indicated. The anal segment much more extended than in *concinnulus*, the styles more slender and asymmetrical, the left one larger and slightly notched at apex.

Color black above and below, the carinae on vertex and pronotum narrowly light, a pair of white spots on the carinae between the eyes and another pair on the extended apical margins of the front. Mesonotal carinae concolorous or slightly orange, elytra milky, the nervures white throughout, except the marginal nervures, heavily and closely punctured with black and clothed with long curved black hairs. The forks and cross-nervures broadly black. The stigma coriaceous white except for aggregated punctures on the boundary nervure.

Holotype ♀, allotype ♂, and 4 paratypes May 15, 1933 and nine paratypes May 19, 1929, all taken by the writer at Tucson, Ariz. This strikingly

distinct species has been taken in the Creosote deserts around Tucson, at Patagonia and Tinajas Altas in Ariz. and near Hermosillo, Mexico.

Oliarus altanus Ball n. sp.

Resembling *apache* Ball, but longer, slenderer with extremely long narrow elytra, and coarse irregular veins that are definitely black in the apical region against the broad white margin. Length 5 mm.

Vertex slightly broader and deeper than in *apache*, the front longer and narrower. Elytra extremely long and slender, the inner fork of the radius approaching and paralleling the medius for some distance, nervures and cells in the apical portion tending to irregularity with the third apical narrow and curved. The stigmal cell extremely long and narrow, four times as long as its width.

Color, black, the bounding carinae, except on mesonotum, narrowly light, median carinae of front tawny, a pair of semi-circular white spots on the carinae adjacent to the eyes. Elytra milky white, the bounding nervure broadly white, the remaining nervures either all dark or dark spotted at base and all dark towards apex in striking contrast to the margin.

Holotype ♀, allotype ♂, and two male paratypes taken by the writer at Tinajas Altas, Ariz. May 17, 1932.

Oliarus dondonius Ball n. sp.

Resembling *sementinus* Ball in color, slightly smaller, but with a vertex one half as wide. Form of *yavapanus* Ball nearly, much paler with a pale stigma. Pale tawny with a castaneous mesonotum. Length 4.5–5.5 mm.

Vertex as in *yavapanus* nearly, the fovae narrowed, pronotum much shorter and rarely reaching the epaulets at the shoulders. Elytra slightly broader with only 5 anteapical cells and a narrow stigma, half longer than its basal width.

Color, pale tawny, the elytra paler. The face in the males, the lateral fovae and sometimes longitudinal stripes on the mesonotum, brown. Elytra with the nervures on the basal half indistinct, becoming tawny, towards the apex with the cross nervures smoky.

Holotype ♀, allotype ♂, and 10 paratypes, Tucson, Ariz. July 24, 1930, 4 paratypes, Grand Junction, Aug. 7, 1906, all taken by the writer on sea blite (*Dondia*). This species is common in alkaline areas from western Colorado through Utah to Arizona and Sonora, Mexico. It is a smaller and much narrower headed species than *sementinus* which it otherwise resembles.

ADVANCE SUMMARIES

BIOLOGY.—*Viability of bacteria in air.*[1] W. F. WELLS, Harvard School of Public Health. (Communicated by W. H. BRADLEY.)

A technique has been devised for study of the viability of droplet nuclei infection in air, by determining the differential disappearance rates in a controlled atmosphere of the infection and of the nuclei, and will be described more fully in a later publication. Preliminary experiments demonstrate that

[1] Presented before Section N. of the American Association for the Advancement of Science, Dec. 27, 1933. Received April 24, 1934.

the viability of pathogenic micro-organisms constitutes a more important limiting factor in the localization of droplet nuclei infection than does the rate at which droplet nuclei settle from the atmosphere.

Since the rate of fall of small droplets is proportional to the surface, and the rate of change of surface is constant, the distance a small droplet falls before ceasing to be a droplet is proportional to the fourth power of the diameter. Droplets less than 0.1 mm. in diameter, expelled from the nose or mouth, will dry under ordinary atmospheric conditions before reaching the ground. Droplet nuclei from broth culture of *B. subtilis*, atomized into a still chamber of 200 cubic feet capacity, were recovered from the air after several days. Though resistant organisms could be recovered from the air of the experimental chamber up to a week after inoculation, Pfeiffer's bacillus was not recovered after one hour.

Four organisms typical of infections of the passages of the upper respiratory tract, *B. pneumoniae*, *B. diphtheriae*, *Streptococcus hemolyticus* and *Streptococcus viridans*, were recovered from the air in small numbers forty-eight hours after inoculation, although in rapidly decreasing numbers. Organisms typical of the digestive tract, *B. coli*, *B. typhosus*, *B. paratyphoid A*, and *B. dysenteriae Hiss Y*, were not recovered after eight hours and were invariably absent at the end of the first day. Bacteriophage was recovered and identified after being suspended in air for 24 hours. It had decreased in a manner characteristic of microorganisms.

CONCLUSIONS

A distinction must be made between droplets, droplet nuclei, and dust, in considering air-borne infection. Droplets larger than 0.2 mm. are localized by rate of fall to the vicinity of the source both in time and space. Droplet nuclei derived from evaporation of droplets less than 0.1 mm. diameter are dispersed in time and space. Localization of dust also varies with the size of the particles. Droplet infection is largely localized and concentrated, whereas Droplet nuclei infection tends toward dispersion and dilution and the possibility of infection is limited in time chiefly by the viability of the microorganisms. Dust infection may be localized either in space by the localization of particles, or in time by the viability of the infection.

SCIENTIFIC NOTES AND NEWS

Prepared by Science Service

NOTES

National Academy of Sciences.—The spring meeting of the National Academy of Sciences was held in Washington, April 23, 24 and 25, under the presidency of Dr. W. W. CAMPBELL. The principal evening address was delivered by Dr. EDWIN HUBBLE of the Mount Wilson Observatory of the

Carnegie Institution of Washington, on "The Realm of the Nebulae." Dr. HUBBLE described the present Observable Region as having a diameter of some 600 million light years, and containing approximately 100 million known spiral nebulae. A substantial enlargement of the Observable Region, the speaker stated, can be expected after the completion of the 200-inch reflector now under construction.

Spectrographic detection of large proportions of methane in the atmospheres of the major outer planets was announced at the meeting through a telegram sent by Director V. M. SLIPHER of Lowell Observatory, Flagstaff, Ariz. The tell-tale lines in the spectra of Jupiter, Saturn, Uranus and Neptune were interpreted in considerable part by Dr. ARTHUR ADEL of the University of Michigan. Presence of massive quantities of methane in the atmospheres of the giant planets has a possible significance for the still unsolved riddle of their surface temperatures, Dr. HENRY NORRIS RUSSELL of Princeton University said, in commenting on Dr. SLIPHER's telegram. At a temperature of −161.4 degrees Centigrade this gas becomes a liquid, unable to betray its presence through reflected light rays. Of course, under the different gravity and atmospheric-density conditions on the great planets the boiling point of methane might be different.

The intensity of a sound and its frequency are quite distinct physical attributes, but the corresponding psychological attributes of loudness and pitch are not so independent; a loud tone sounds lower in pitch than a high one, and a low tone sounds unduly loud, it was indicated by a report of the National Academy of Sciences delivered at the annual meeting by Dr. HARVEY FLETCHER, of the Bell Telephone Laboratories. It was found that a 50-cycle tone with an intensity which is 10,000 times that of a just barely audible sound appears just as loud as a 1,000 cycle tone with an intensity 1,000,000,000 times that of the threshold. The apparent pitch of a tone also depends upon its intensity. The pitch of a 200-cycle tone was heard as being as much as a quarter of an octave lower at the very high intensities than at the low intensities. However, when the tones were of very high frequencies, near 2,000 or 3,000 cycles, such changes of apparent pitch with intensity were not observed.

Distilled water, replacing ordinary tap water containing its usual quota of highly dilute mineral substances, produces anesthesia in plant cells, seemingly by dissolving out of them some unknown organic stuff. This observation was presented by Dr. W. J. V. OSTERHOUT and Dr. S. E. HILL of the Rockefeller Institute for Medical Research. When cells of *Nitella* are placed in distilled water they presently become completely anesthetic, transmitting no variations in potential along the protoplasm. This loss of sensitivity is hastened by the addition of acids or alkalis, but slowed by the addition of calcium. The anesthetic state passes off again when the cells are replaced in tap water.

Honored after his death, for his researches on the skull of ancient Peking Man, Dr. DAVIDSON BLACK was given the posthumous award of the Elliot Medal for 1931, which carries with it a cash honorarium of $200. Dr. BLACK was designated to receive the award before his death in Peiping on March 15; the medal and check were placed in the hands of Dr. FRANK DAWSON ADAMS, foreign associate of the Academy, on behalf of Dr. BLACK's widow. The first award of the Charles Doolittle Walcott Medal and honorarium of $1,350 was made to Dr. DAVID WHITE of the U. S. Geological Survey, in recognition of his work on the pre-Cambrian algae of the Grand Canyon of Arizona. Other

honors bestowed by the Academy were: the Agassiz Medal, awarded to Dr. BJORN HELLAND-HANSEN of the Geophysical Institute, Bergen, Norway; the Public Welfare Medal, awarded to Dr. DAVID FAIRCHILD, of the U. S. Department of Agriculture; and the Elliot Medal and honorarium of $200 for 1930, awarded to Dr. GEORGE ELLETT COGHILL, Wistar Institute of Anatomy and Biology, Philadelphia.

The American Geophysical Union.—Penetrating radiations resembling cosmic rays, but softer, are thrown upward into the air from the tops of thunderstorm clouds, like spray from the tops of waves. They come to earth again to the eastward of the cloud, drawn down by the earth's magnetic field. These radiations, which are made up of negative electrons, were described before the meeting of the American Geophysical Union here by Dr. B. F. J. SCHONLAND of the University of Capetown, who is visiting in the United States. Dr. SCHONLAND stated that when he began his investigations of penetrating radiations caused by lightning, he thought that he would find electrons poured directly earthward as well as upward into the higher levels of the air; but this proved not to be the case. He has found that lightning-engendered radiations can influence cosmic-ray detecting instruments as much as a thousand miles away from a thunderstorm, and he stated that another investigator claims for them an even greater radius of action. But their effect is always felt to the eastward of the storm that gives them birth, never toward the west. The research was undertaken with the idea of finding out whether cosmic rays were entirely the product of thunderstorms, as one student of the subject had claimed. Dr. SCHONLAND is convinced that this is not the case; nevertheless, there are enough lightning-caused penetrating radiations to make it necessary for researchers on cosmic rays to take them into account, if their figures are not to be falsified by thunderstorms.

New 40-inch reflector at Naval Observatory.—The new 40-inch reflector built for the U. S. Naval Observatory under the direction of GEORGE W. RITCHEY has been completed. The instrument is designed especially for spectrographic observation. Figured on new curves calculated by Mr. RITCHEY and HENRI CHRÉTIEN, it is expected to be as efficient as a reflector of several times its aperture based on the conventional paraboloid figure.

It is the first air cooled telescope. The entire observatory building is built of very light metal, with double walls, so that at night the temperature will soon become the same as the surrounding air. With more massive buildings, the stone and brick absorb heat all day, and give it off long into the night, producing objectionable air currents which spoil the clearness of the telescopic images. In order to keep the telescope at its night time temperature, a felt canopy will be placed over it in the daytime. This is connected with air cooling equipment, so that all day the telescope will be kept at the temperature expected that night.

The tube of the telescope is constructed with a unique system of counterpoises, so as to prevent bending. Convenience of the observer is also remembered, and he is provided with a movable observing platform which automatically keeps him at the eyepiece as the telescope turns. Thus he does not need to interrupt his work frequently to adjust himself.

U. S. Weather Bureau.—With the cooperation of the War, Navy, and Commerce Departments, the Weather Bureau of the U. S. Department of Agriculture, on July 1, 1934, will launch part of its new program for increasing the accuracy of its forecasts, W. R. GREGG, chief, has announced. This new program, among other things, calls for more stations for upper air

soundings by airplanes and for more frequent daily forecasts. The part covering more airplane observations can now be put into effect.

The air-mass method of forecasting, long recognized as an aid to accuracy and to longer forecasts, has never been practicable in the Weather Bureau's daily routine because of the difficulty of getting the needed upper-air observations. Facilities offered by Army and Navy pilots at more than a dozen selected stations, at six specially-equipped Weather Bureau airway stations, and at one cooperative station at the Massachusetts Institute of Technology, now remove this difficulty. The Department of Commerce will provide for the transmission of the observations from the points where they are taken to the forecasting stations. According to the present plan, observation flights will be confined to one a day, each beginning about half past five (E.S.T.) in the morning and reaching a maximum height of 17,000 feet above sea level. These flights will be made by Army and Navy pilots and by commercial aviators hired for the purpose by the Weather Bureau. Meteorologists of the Weather Bureau assigned to the air-observation stations will compute, code, and transmit to forecast stations the information the meteorographs bring down. This information will give forecasters an important supplement to the morning surface observations in drawing the weather maps to be used in making the daily forecasts.

Children's Bureau, U. S. Department of Labor.—The complete, detailed report of the study of maternal deaths in 15 states made by the Children's Bureau at the request and with the cooperation of state medical societies and state boards of health is now in press and will appear at an early date. Interest in this subject has been intensified by discussion of the recently published report of similar study in New York City by the New York Academy of Medicine. The Children's Bureau study was made before that of the New York Academy of Medicine which used the same schedule or questionnaire. In both studies the material was gathered by physicians through personal interviews with those who attended the women who died and in both studies the international list of causes of death was used as the basis of analysis. The most obvious differences between the two studies lie in the area covered: 15 states in the children's Bureau study, 47 per cent of deaths being in urban and 53 per cent in rural areas, whereas the New York City deaths were all urban; the larger number of deaths: 7,400 in the Children's Bureau study and 2,000 in the New York study; and the greater detail of analysis in the Children's Bureau study.

Personal Items

Dr. Ales Hrdlicka, of the U. S. National Museum, is again spending the summer in archaeological work among the Alaskan islands. He has with him a group of student volunteers.

Dr. F. A. Wolff, chief of the telephone standards section, National Bureau of Standards, has been designated as a member of the Committee of Departmental Representatives appointed at the instance of Admiral Peoples, Director of the Procurement Division, to determine the cost of the Government's communication services, including telephone, telegraph, and radio.